HKS

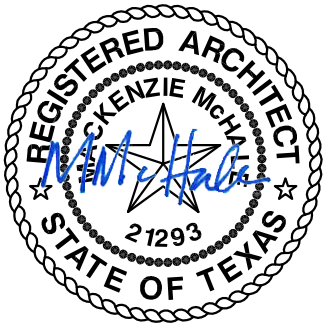
HKS Project No. 23376.000

Project Manual

El Paso Children's HOSPITAL

# 8th Floor Tenant Improvements
# El Paso, Texas

100% Construction Documents Reissue
March 06, 2023

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UMC EL PASO CHILDREN'S HOSPITAL
8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

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SECOND COLUMN

☐ INDICATES SECTION IS **NOT** INCLUDED WITH THIS ISSUE

☒ INDICATES SECTION IS INCLUDED WITH THIS ISSUE

THIRD COLUMN: REVISION NUMBER ("O" INDICATES ORIGINAL, REVISIONS ARE NUMBERED CONSECUTIVELY)

FOURTH COLUMN: SPECIFICATION SECTION NUMBER

FIFTH COLUMN: SPECIFICATION SECTION TITLE

**NOTE FOR REVISED SPECIFICATION SECTIONS**

1. DELETED INFORMATION IS INDICATED BY A STRIKETHROUGH (IE, ~~THIS IS DELETED~~).
2. NEW INFORMATION IS INDICATED BY A DOUBLE UNDERLINE (IE, THIS IS ADDED).
3. ALL REVISED INFORMATION IS FURTHER IDENTIFIED BY A HEAVY VERTICAL LINE TO THE RIGHT OF ALL REVISIONS IN EACH INDIVIDUAL SPECIFICATION SECTION (REFER TO HEAVY BOLD LINE TO THE RIGHT FOR AN EXAMPLE).

## ISSUES

| | |
|---|---|
| 2021-02-08 | 100% Construction Documents |
| 2023-03-06 | 100% Construction Documents Reissue |

## DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS



## DIVISION 01 - GENERAL REQUIREMENTS

## DIVISION 02 - EXISTING CONDITIONS



## DIVISION 03 - CONCRETE



## DIVISION 04 - MASONRY

NO SECTIONS

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EL PASO, TEXAS

SECTION 00 3100

# AVAILABLE PROJECT INFORMATION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section references other information relevant to the construction of this Project that is available project information.

B. At the request of the Owner, the information identified below represents services that have been provided by others, not as a Consultant, regarding conditions that affect this Project that are beyond the responsibilities of the Consultants. Reference to such information herein is solely for the convenience of the Owner.

C. Bidders are expected to examine the site and the information available from the Owner to determine for themselves the conditions to be encountered.

D. If conditions other than those indicated in the information available from the Owner are encountered before or during construction, notify the Owner before work continues.

### 1.2 INFECTION CONTROL RISK ASSESSMENT REPORT

A. The Owner's Risk Assessment Consultant has assessed the environmental impact of the work on the existing, adjacent healthcare functions, and has prepared an Infection Control Risk Assessment (ICRA) report that includes specific requirements of the Contractor.

B. Copies will be provided by the Owner.

C. The ICRA establishes strategic infection control provisions and requirements for the purpose of controlling the dissemination of airborne micro-organism contaminants encountered or generated during the construction process through the use of containment protocols and environmental monitoring.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION (NOT USED)

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 00 7300

SUPPLEMENTARY CONDITIONS

PART 1 - GENERAL

1.1 GENERAL

A. The Supplementary Conditions modify, change, delete from or add to the General Conditions and shall apply to each and every Section of the Work as though written in full therein.

B. The following paragraphs and subparagraphs take precedence over the General Conditions. Where any part of the General Conditions is modified or deleted by the Supplementary Conditions, the unaltered provisions remain in effect.

C. Correlation and Intent of the Contract Documents:

1. Sections of Division 01 - General Requirements govern the execution of all sections of the specifications.
2. Summary paragraphs placed at the beginning of the Sections present a brief indication of the principal Work included in that Section, but do not limit Work to subject mentioned nor purport to itemize Work that may be included.
3. The Relation of Specifications and Drawings shall be equal authority and priority. Should they disagree in themselves, or with each other, bids shall be based on the most expensive combination of quality and quantity of work indicated. The appropriate Work, in the event of the above mentioned disagreements, shall be determined by the Architect.
4. Should the Drawings disagree themselves, figures shall govern over scaled measurements, large scaled Drawings shall govern over small scale Drawings, the greater quantity of work or materials shall be furnished and performed; the descriptive writings shall govern over legends indicating material or conditions and the Agreement takes precedence over all other Contract Documents.
5. Failure to report a conflict in the Contract Documents shall be deemed evidence that the Contractor has elected to proceed in the more expensive manner.
6. Instructions, directions and requirements as specified shall be considered to be followed by the phrase "unless otherwise specified or indicated".

1.2 INTERPRETATION

A. In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

1.3 INFORMATIONAL SUBMITTALS

A. Informational submittals may be so identified in the Contract Documents.

1.4 PROFESSIONAL CERTIFICATION

A. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

PART 2 - (NOT USED)

PART 3 - (NOT USED)

END OF SECTION

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SECTION 01 1000

SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Owner-furnished, Owner-installed (OFOI) products.
2. Owner-furnished, Contractor-installed (OFCI) products.
3. Worker conduct and appearance - work rules.
4. Healthcare facility renovation work.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and drawing conventions.

1.2 OWNER-FURNISHED, OWNER-INSTALLED (OFOI) PRODUCT

A. The specific product is not in this contract, and actual installation of the product will be made by the Owner.

B. Products will be indicated as follows:

1. Product prefixed with "Space for"
2. N.I.C.
3. Owner Furnished - Owner Installed
4. Product noted as "Future"

C. Roughing-in for Owner Furnished, Owner Installed Product is provided by applicable Sections governing the type of work. Obtain rough-in requirements from Owner.

1.3 OWNER-FURNISHED, CONTRACTOR-INSTALLED (OFCI) PRODUCT

A. Install products indicated as follows:

1. "Owner Furnished, Contractor Installed".
2. "Reuse".
3. "Relocate".

B. Provide labor, transportation, materials, tools, appliances and utilities necessary for the following:

1. Relocated Products:

a. Removing installed product from the Owner's existing facility, as required.
b. Transportation of product from Owner's facility to the job site.

2. Receiving and storage of Owner furnished, Contractor installed product, as required.

3. Providing materials and components for the product as necessary to install in an operating condition, but not including repairing of existing damages to the product.
4. Modification of product only as specified under the particular item.
5. Installation of product in this project, complete and in operating condition, including the adjusting and calibration of the product as necessary for proper operation.
6. Testing of product.
7. Paying of fees, licenses, and taxes in conjunction with the installation of the product.
8. Roughing-in and final utility connections for the Owner furnished, Contractor installed product remains the work of Sections governing the specific utility.

1.4 WORKER CONDUCT AND APPEARANCE - WORK RULES

A. General: The conduct and appearance of each worker at the jobsite is of paramount importance. The Owner reserves the right to require any worker to be reassigned to work outside the Owner's property.

1. Privacy: Where applicable, conduct work of the Contract with the maximum effort to maintain the privacy of the Owner's operations, staff, and clientele. Do not permit workers to peer into other areas of the building visible from the work area. Invasion of privacy is a major infraction of the work rules.
2. Conduct and Demeanor: Construction workers shall treat other construction workers, Owner's staff, clientele, and visitors (as applicable) professionally with respect and courtesy.
3. Physical Appearance: Require each worker to dress appropriately in a clean, neat, and professional manner.
4. Radios and Television: The use of entertainment devices including personal devices with headphones or earphones is prohibited at all times. Control the volume of communication radios and loudspeakers to avoid creating a nuisance.
5. Tobacco Products: The use of tobacco products is prohibited.
6. Language: The use of foul language is prohibited.
7. Loud Conduct: Screaming, yelling, and unnecessary loud conduct is prohibited.
8. Physical Actions: Running, horseplay, fighting, and other unprofessional conduct is prohibited. Fighting is a major infraction of the work rules.
9. Stealing: Stealing of any material, objects, furnishings, equipment, fixtures, supplies, clothing, or other items is prohibited and a major infraction.
10. Sexual Harassment: All forms of physical and verbal sexual harassment including, without limitation: touching; whistling; sexually explicit stories, jokes, drawings, photos, and representations; exhibitionism; and all other sexually oriented offensive behavior is prohibited.
11. Roaming: Construction personnel shall not be allowed to roam, or wander about, the existing facilities.
12. Eating: Construction personnel shall not use the existing Dining Area for breakfast, lunch, or dinner.
13. Parking: Construction personnel shall only park in designated areas reserved for construction parking.
14. Penalties: First infraction of the work rules shall result in a verbal warning from the Owner. Second infractions shall result in being requested to leave the Owner's property. Owner's decision in such matters shall be final with no exceptions.

B. Warnings and Dismissal: For minor infraction of the rules, the Owner may issue a warning. Only one warning will be allowed per worker, and a second infraction shall result in immediate dismissal of the worker from the Owner's property. For major infractions such as invasion of privacy, the worker shall be dismissed immediately without warning and possibly subject to criminal prosecution.

C. Notification of Workers: Clearly notify and educate each worker about these Work Rules and the requirements for worker conduct and appearance.

1.5 HEALTHCARE FACILITY RENOVATION WORK

A. Interim Life Safety Measures (ILSM): The following Interim Life Safety Measures (ILSM) as established by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) shall be implemented, documented and enforced in and adjacent to all construction areas:

1. Ensure that exits provide free and unobstructed egress. Personnel shall receive training, and the Medical Office Building shall be notified if alternative exits must be designated. Buildings/areas under construction must maintain escape facilities for construction workers at all times. Means of egress in construction areas must be inspected daily.
2. Ensure free and unobstructed access to emergency department/service and for emergency forces.
3. Ensure that fire alarm, detection, and suppression systems are not impaired. A temporary, but equivalent, system shall be provided, and the Medical Office Building shall be notified, when any fire system is impaired. Temporary systems must be inspected and tested monthly.
4. Ensure temporary construction partitions are smoke tight and built of non-combustible or limited combustible materials that will not contribute to the development or spread of fire.
5. Provide additional fire-fighting equipment and use training for personnel.
6. Prohibit smoking in or adjacent to all construction areas.
7. Develop and enforce storage, housekeeping, and debris-removal practices that reduce the flammable and combustible fire load of the building to lowest level necessary for daily operations.
8. Conduct a minimum of two fire drills per shift per quarter.
9. Increase hazard surveillance of buildings, grounds, and equipment with special attention to excavations, construction areas, construction storage, and field offices.
10. Train personnel, and notify the Medical Office Building, when structural or compartmentation features of fire safety are compromised.
11. Conduct organization wide safety education programs to assure awareness of deficiencies, construction hazards, and these ILSM.

1.6 ACCESS TO SITE

A. 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.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Confine constructions operations to work in areas indicated on drawings.
2. Allow for Owner occupancy of site and use by the public.
3. Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times.

4. Do not use drives and entrances for parking or storage of materials.
5. Schedule deliveries to minimize use of driveways and entrances.
6. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
7. Coordinate use of premises under direction of Owner.
8. Assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.
9. Move any stored Products, under Contractor'¢¢s control, which interfere with operations of the Owner or separate contractor.
10. Obtain and pay for the use of additional storage or work areas needed for operations.

C. 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. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. 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. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

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. On-Site Work Hours: Coordinate the limitations relative to working hours in the existing building with Owner.

C. Existing Utility Interruptions: Refer to Division 01 Section "Execution" for requirements.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than 72 hours in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

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. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
3. 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.
4. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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# SECTION 01 2300

# ALTERNATES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

### 1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

### 1.3 PROCEDURES

A. Documentation: Show compliance with requirements for accepted alternates and the following, as applicable:

1. 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 accepted alternates.
2. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
3. Samples, where applicable or requested.
4. Certificates and qualification data, where applicable or requested.
5. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
6. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
7. Detailed comparison of Contractor's construction schedule using accepted alternates 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.
8. Cost information, including change in the Contract Sum.

B. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

C. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

D. Execute accepted alternates under the same conditions as other work of the Contract.

E. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

F. Acceptance of Alternates will be exercised at option of Owner in any order or combination.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Refer to drawings.

END OF SECTION

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EL PASO, TEXAS

SECTION 01 2500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.2 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.

1.3 SUBMITTALS

A. Substitution Requests: Submit electronic 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 scanned PDF electronic file of form provided at end of this section or annotated PDF electronic file of electronic form received from Architect matching form provided at end of this section.
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, with reasonable promptness, Architect will request additional information or documentation for evaluation. Architect will notify Contractor of acceptance or rejection of proposed substitution with reasonable promptness. Acceptance of proposed substitution does not constitute approval or inclusion in Contract Documents. Pay applications certification, change orders, and certificate of substantial completion will contain such qualification.

1.4 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.

1.5 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Prior to starting Substitution Process, review proposed recommendations with Architect.

B. Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples for construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.

C. Contractor Representations: By making substitution request, Contractor:

1. Recognizes burden of proof of equality for requested substitution rests with Contractor.
2. Represents and warrants that Contractor has personally investigated requested substitution and determined that it is equal to or superior in all respects to specified Work.

3. Represents and warrants that Contractor will provide same warranties for requested substitution that Contractor would for specified Work.
4. Certifies that cost data presented is complete and includes all related costs under this Contract except for Architect's redesign cost, and waives all claims for additional costs related to requested substitution which may subsequently become apparent.
5. Will coordinate installation of accepted substitution, making such other changes as may be required to make Work complete in all respects.
6. Represents and warrants that accepted substitution will perform same as specified Work would have performed. Should accepted substitution fail to perform as required, Contractor shall replace accepted substitution with specified Work at no additional cost to Owner.

D. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change.

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.

E. Substitutions for Convenience:

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.

PART 3 - EXECUTION (Not Used)

END OF SECTION

# Substitution Request Form

To HKS Contract Manager _____

HKS Project No._____ Project Name _____

Specified Item

| Section | Page | Paragraph | Description |
|---|---|---|---|
| | | | |

The undersigned General Contractor requests consideration of the following:

Proposed Substitution _____

(Include all product data as indicated in Specification Section 01 2500 and any supplemental information as requested by the Architect.)

The undersigned General Contractor warrants to the Architect and Owner that the following paragraphs, unless modified on attachments, are correct.

1. The Proposed Substitution does not affect dimensions shown on Drawings.
2. The cost reduction/increase indicated in item 5 below includes costs for changes to the building design, including engineering, design, detailing and construction costs caused by the requested Substitution. Any additional costs resulting from this substitution will be reimbursed from the cost savings in item 5 or, in it's absence, funded as a project cost.
3. The Proposed Substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the Proposed Substitution.

   The General Contractor further warrants to the Architect and Owner that the function and quality of the Proposed Substitution are equivalent or superior to the Specified Item. The General Contractor further warrants that specification section 01 2500, paragraph 2.1G intent has been met.
5. Total Cost Savings/Increase to the Owner: $_____
6. Compensation to the Architect / Consultant for related Additional Service Fee: $_____

**Manufacturer's Certification of Equal Quality**

I_____represent the manufacturer of the Proposed Substitution item and hereby certify and warrant to the Architect and Owner that the function and quality of the Proposed Substitution are equivalent or superior to the Specified Item.

| Manufacturer's Representative | Date | Company |
|---|---|---|
| | | |

Acceptances

1.

| General Contractor Acceptance | Date | Company |
|---|---|---|
| | | |

2.

| Owner Acceptance | Date | Company |
|---|---|---|
| | | |

3.

| Architect Acceptance | Date | Company |
|---|---|---|
| | | |

***Recommend Acceptance:*** ☐***Yes*** ☐***No***

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EL PASO, TEXAS

SECTION 01 2600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 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 Architect's Form HKS-710 "Architect's Supplemental Instructions"; copy attached at the end of this Section.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposed Change: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time using Architect's Form HKS-709 "Proposed Change"; copy attached at the end of this Section. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposed Changes issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposed Change or with reasonable promptness, when not otherwise specified, after receipt of Proposed Change, 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. Include updated Submittal Schedule showing effect of the change.

B. Contractor-Initiated Proposed Change: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect using Contractor's Standard Form.

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. Include updated Submittal Schedule showing effect of the change.
7. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: If applicable, see Division 01 Section "Allowances" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: If applicable, see Division 01 Section "Unit Prices" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of unit-price work.

C. Alternates: If applicable, see Division 01 Section "Alternates" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of alternate work.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposed Change, Architect will issue a Change Order for signatures of Owner and Contractor on Architects Form HKS-701 "Change Order"; copy attached at the end of this Section.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on Architects Form HKS-714 "Construction Change Directive"; copy attached at the end of this Section. Construction 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

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# Change Order

**To:**
[Contractor Name & Address]

**Project & Address:**
[Project Name & Address]

## The Contract is changed as follows:

Addition of Civil and Structural Pier Package (attached as Exhibit One—Change Order One) to the original contract.

**Change Order No.:**
[Number]
**Initiation Date:**
[Date]
**Architects Project No.:**
[Project No.]
**Contract for:**
[for]
**Contract Date:**
[Date]

## Summary:

- The original (Contract Sum)(Guaranteed Maximum Cost) was ..... **$275,000.00**
- Net change by previously authorized Change Orders ..... **$0.00**
- The (Contract Sum) (Guaranteed Maximum Cost) prior to this Change Order was ..... **$275,000.000**
- The (Contract Sum) (Guaranteed Maximum Cost) will be (increased)(decreased)(unchanged) by this Change Order ..... **$4,411,665.00**
- The new (Contract Sum) (Guaranteed Maximum Cost) including this Change Order will be ..... **$4,686,655.00**
- The Contract Time will be (increased) (decreased) (unchanged) by ..... **0 Days**
- The Date of Substantial Completion as of the date of this Change Order therefore is ..... **October 1, 2016**
- Changes included in the summary above (do) (do not) include modifications which have been authorized by Construction Change Directive(s).

| | | | |
|---|---|---|---|
| XXX | XXX | | XXX |
| **Owner** | **Address** | **Signature** | **Date** |
| HKS Inc. | 999 18th St #2255N, Denver, CO 80202 | | XXX |
| **Architect** | **Address** | **Signature** | **Date** |
| XXX | XXX | | XXX |
| **Contractor** | **Address** | **Signature** | **Date** |

This Change Order is NOT in effect and will not be included in the Contract Documents until signed by the Owner, Architect and Contractor.
Changes included herein are subject to all conditions affecting them under the substitution specification section.

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350 N Saint Paul St #100
Dallas, TX 75201





# Proposed Change

**To:**
[Contractor Name & Address]

**Project & Address:**
[Project Name & Address]

**Project No.:**
[Number]
**Proposed Change No.:**
[PC No.]
**Issue Date:**
[Date]
**Owner:**
[Owner Name]

This is not a change order. Do not proceed with this work until authorized by Owner in writing below. Submit an itemized breakdown of labor and materials, and perform all work described herein in accordance with applicable Contract Documents.

Contractor pricing is due **XX** days after the issue date noted on the left.

## Description:
[Changes]

**Submitted by**

### Contractor's Proposal

| By | Date | Cost |
|---|---|---|

### Recommended

| By | Date |
|---|---|

### Owner's Authorization to Proceed

| By | Date |
|---|---|

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# Architect's Supplemental Instruction

**To:** (Contractor)
[Contractor]

**Project & Address:**
[Project Name & Address]

**Project No.:**
[Number]
**ASI No.:**
[Number]
**Issue Date:**
[Date]
**Contract for:**
[Contract for]

The work is to be executed in accordance with the supplemental instructions contained herein without change in Contract Time or Contract Sum. Before proceeding with these instructions return a copy to the architect indicating your acceptance of these instructions for minor change(s) to the work as consistent with the Contract Documents.

**Description:**
[Description]

**Issued:** HKS, Inc.

**Architect** **Date**

**Accepted**

**Contractor** **Date**

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# Construction Change Directive

**To:**
[Contractor Name & Address]

**Project & Address:**
[Project Name & Address]

You are directed to make the following change(s) in this Contract. Please respond with your pricing basis, amount and modification to the contract time within **XX** calendar days from the initiation date listed above.

## Description:

[Description]

**Project No.:**
[Number]
**CCD No.:**
[Number]
**Initiation Date:**
[Date]
**Contract for:**
[Contract for]
**Contract Date:**
[Date]

## Proposed Modifications:

The proposed basis of modification to the Contract Sum or Guaranteed Maximum Price is:

- ☐ Guaranteed Maximum not to exceed: **$XXX.XX**
- ☐ Lump Sum (increase)(decrease) of: **$XXX.XX**
- ☐ Unit Price of: **$XXX.XX**
- ☐ As provided in sub-paragraph 7.3.6 of AIA Document A201, 1997 edition.
- ☐ As follows:

The Contract time is proposed to (be modified)(remain unchanged).
The proposed modification, if any, is (an increase of **XX** days) (a decrease **XX** days).

| | | | |
|---|---|---|---|
| XXX | XXX | | XXX |
| **Owner** | **Address** | **Signature** | **Date** |
| HKS Inc. | XXX | | XXX |
| **Architect** | **Address** | **Signature** | **Date** |
| XXX | XXX | | XXX |
| **Contractor** | **Address** | **Signature** | **Date** |

This document shall become effective immediately upon execution by the Owner and Architect.
The Contractor shall proceed with the changes described herein immediately upon receipt.

Execution by the Contractor is an indication of agreement with the modification in the Contract Sum and Contract Time indicated herein.

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 01 2900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Accepted Alternates.

2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments; provide subschedules showing values coordinated with each phase of payment.
4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work; provide subschedules showing values coordinated with each element.
5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Division 01 Section "Summary."

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Architect.
c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange the schedule of values in tabular form, in format accepted by Architect, with separate columns to indicate the following for each item listed:

a. Related Specification Section or Division.

b. Description of the Work.
c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders.
g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

1) Labor.
2) Materials.
3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance or bonded warehousing.

6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances (If Applicable): Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances (if applicable), as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Alternates (If Applicable): Provide a separate line item in the schedule of values for each accepted alternate.
9. Change Orders: Provide a separate line item in the schedule of values for each change order.
10. Separate Owner-Consultant Contracts: Provide a separate line item in the schedule of values for each separate Owner-Consultant related Work item.
11. Purchase Contracts: When applicable, provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
12. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

13. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

1. If the Agreement does not state payment dates, establish dates at preconstruction conference.
2. Submit draft, or pencil, copy of Application for Payment seven days prior to due date for review by Architect.

C. Application for Payment Forms: Unless directed otherwise by Owner, use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Stored Materials: If accepted by Owner, include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from General Contractor, subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.

    a. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Schedule of unit prices.
6. Submittal schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. When applicable, this application shall reflect Certificate(s) of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.

3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. If applicable, final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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EL PASO, TEXAS

SECTION 01 3100

# PROJECT MANAGEMENT AND COORDINATION

## PART 1 - GENERAL

### 1.1 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 Web site.
5. Project meetings.

### 1.2 DEFINITIONS

A. Project communications documents shall be defined as the following:

1. Letters.
2. Memoranda.
3. E-Mail Communications/Internet Communications/Project Management Software Communications.
4. RFI (Request for Information - Contractor).
5. RFI-A (Request for Information - Architect).

### 1.3 FORMAT

A. Letters and Memoranda: Submit in formats acceptable to the Architect.

B. E–Mail Communications/Internet Communications/Project Management Software Communications: Submit in forms and formats acceptable to and as approved by the Architect.

C. RFI (Request for Information - Contractor): Submit on forms furnished by the Architect, or on other forms as approved by the Architect. Unless otherwise approved use Architect's Form HKS-750, "Request for Information"; copy attached at the end of this Section.

D. RFI-A (Request for Information - Architect), will be submitted by Architect to Contractor on Architects standard form.

### 1.4 PROJECT COMMUNICATIONS DOCUMENTS

A. Letters and Memoranda documents shall be submitted in a timely manner so as to facilitate project delivery and coordination. Routing of communications shall be as established in the Contract, the Contract Documents and the Pre-Construction Conference. Communications documents shall be transmitted or forwarded in a manner consistent with the schedule and progress of the work.

B. E–Mail Communications, Internet Communications, and Project Management Software programs must be compatible with the Architect's and Owner's computer systems and equipment. The responsibility for all costs for management of these systems, including, but not limited to, licensing, onsite training or other training necessary for the proper operation of such systems, shall be by the Contractor. The Contractor shall keep written records and hard file copies of all electronic communications. Failure of the Contractor to keep such records shall waive the Contractor's right to rely on such communications and such communications shall be deemed to have not taken place.

C. RFI (Request for Information - Contractor) shall be defined and limited to a request from the Contractor seeking interpretation or clarification of the requirements of the Contract Documents. Such requests shall comply with the following requirements:

1. RFI requests shall be submitted in a timely manner, well in advance of related work, and allow sufficient time for the resolution of issues relating to the request for interpretation or clarification. Contractor shall schedule the submission of RFI's so as to moderate and manage the flow of RFI requests. RFI's shall be submitted in a manner consistent with the schedule and progress of the work, and shall not be submitted in a sporadic and/or excessive manner.
2. RFI requests shall be numbered in a sequential manner and contain a detailed description of the areas of work requiring interpretation or clarification. Include drawing and specification references, sketches, technical data, brochures, or other supporting data as deemed necessary by the Architect, for the Architect to provide the interpretations and clarifications requested.

    a. The Contractor shall include a "Proposed Solution" to the issue requiring interpretation or clarification.

3. RFI's submitted to the Contractor by Sub-Contractors, vendors, suppliers, or other parties to the work shall be reviewed by the Contractor prior to submission to the Architect. If the Architect deems that such RFI requests have not been adequately reviewed by the Contractor, such requests will be returned to the Contractor for further action. Sub-Contractor's RFI shall contain a "Proposed Solution".
4. RFI requests shall not contain submittals, substitutions requests, routine communications, correspondence, memos, claims, or any information required by other areas of the Contract Documents. RFI requests containing such information will be returned to the Contractor without action by the Architect.
5. RFI requests are limited to a request for interpretation or clarification of the requirements of the Contract Documents. Interpretations provided by the Architect shall not change the requirements of the Contract or the Contract Documents. If the Contractor determines that the Architect's response to an RFI gives cause for a change in the Contract or the Contract Documents, the Contractor shall promptly, within 5 working days, give written notice to the Architect of request for adjustments. Requests for adjustments to the Contract shall be submitted in a manner consistent with the terms and conditions of the Contract Documents.
6. If the Architect, after review, determines that any RFI has been submitted in an incomplete manner, is unnecessary, or does not otherwise comply with the requirements of this Section, the RFI will be returned without action to the Contractor. The Contractor shall delete the original submittal date from the RFI log and enter a new submittal date at the time of re-submittal.
7. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of Project Web site. Software log with not less than the following:

a. Project name.
b. Name and address of Contractor.
c. Name and address of Architect.
d. RFI number including RFIs that were returned without action or withdrawn.
e. RFI description.
f. Date the RFI was submitted.
g. Date Architect's response was received.

8. 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.

a. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

D. RFI-A (Request for Information - Architect) shall be defined as a request by the Architect for information relating to the obligations of the Contractor under the Contract.

1. After receipt of an RFI-A the Contractor shall provide a written response to the Architect within 5 working days. Responses shall be thorough, complete and shall contain all information requested by the Architect.
2. An RFI-A shall be limited to a request by the Architect for information related to the project. The RFI-A shall not be construed as authorizing or directing a change in the Contract or the Contract Documents.

E. Revisions to Construction Documents: Responses to requests for information (RFI) shall not serve as construction documents; and the Contractor shall not incorporate RFI responses into construction of the Project, unless such answers bear the seal and signature of a licensed design professional.

1.5 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 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 Project Web site. Keep list current at all times.

1.6 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.

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

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

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.7 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates 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. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
e. Indicate required installation sequences.
f. 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.

B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
3. BIM File Incorporation: When applicable, develop coordination drawing files from Building Information Model (BIM) established for Project.

a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.

4. If approved by Owner, Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
b. Digital Data Software Program: Drawings are available in Autodesk Revit and/or Autocad; and compatible with Microsoft Windows operating system.
c. Distribution: Digital data files shall only be distributed via the HKS Thru site with acceptance of HKS data licensing agreement.

1.8 PROJECT WEB SITE

A. Use Architect's Project Web site implementing Architect's electronic project management software system for purposes of managing project communication and documentation until Final Completion.

B. Contractor, subcontractors, and other parties granted access to Project Web site shall execute a data licensing agreement in the form of AIA Document C106.

1.9 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: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.
4. Attendance: Document attendance of all participants.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction.

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.

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, and coordination with adjacent activities. Prepare agenda appropriate to Work.
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, at a time to be decided 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. If applicable, requirements for completing sustainable design 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. If applicable, coordination of separate contracts.
l. If applicable, 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: Conduct progress meetings at regular 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 or as needed:

1) Interface requirements.
2) Sequence of operations.
3) If applicable, resolution of BIM component conflicts.
4) Status of submittals.
5) If applicable, status of sustainable design documentation.
6) Deliveries.
7) Off-site fabrication.
8) Access.
9) Site utilization.
10) Temporary facilities and controls.
11) Work hours.
12) Hazards and risks.
13) Progress cleaning.
14) Quality and work standards.

15) Status of correction of deficient items.
16) Field observations.
17) Status of RFIs.
18) Status of proposal requests.
19) Pending changes.
20) Status of Change Orders.
21) 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.

F. Coordination Meetings: Conduct Project coordination meetings on an as-needed basis. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: 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 meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Review present and future needs of each contractor present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) If applicable, 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) Work hours.
11) Hazards and risks.
12) Progress cleaning.
13) Quality and work standards.
14) Change Orders.

## PART 2 - PRODUCTS

### 2.1 ELECTRONIC PROJECT MANAGEMENT SOFTWARE

A. General: So as to expedite electronic review process, process all documents through a web-based software service. Sending documents via email, FTP or paper will not be accepted.

1. Basis of Design (Product Standard):

a. Newforma, Inc.; Newforma Project Cloud, web-based software.

1) Website: www.NewformaProjectCloud.com
2) E-mail: projectcloud@newforma.com
3) Phone: (800) 303-4650

B. Performance Requirements:

1. Project License:

a. Cloud based (no hardware required).
b. Unlimited user accounts.
c. Functionality to support subcontractors, contractors, architects and consultants.
d. Provide access to data for all project team members at no cost to the individual users.

2. Training and Support:

a. Dedicated project training.
b. Phone support.

3. Archive:

a. Export all data to an offline archive at the completion of the project.
b. Provide archive to architect, contractor and owner.
c. Archive shall include all attachments, meta data, review comments and time stamp history.

4. Submittals and RFIs:

a. Customizable logs and reporting accessible by all users.
b. Logs shall automatically update as submittals and RFIs are processed.
c. Automated routing of submittals and RFIs to design team based on trade.
d. Automated email notifications when submittal or RFI has been assigned or returned to a user.
e. Automated weekly email to design team users of overdue items.
f. Automatic sequential numbering per spec section for submittals.
g. Two sets of due dates - one overall due date and a consultant due date.
h. Built-in web-based markup tools to support a concurrent review of submittal and RFI.

5. Submittal Register:

a. Software vendor shall take specifications and build the required list of submittals and import into the software.

6. Drawing Management:

a. Provide current set of drawings and specifications through a centralized index.
b. Automated association of PDFs to the centralized index.
c. Manage drawing revisions with customizable review states.
d. Drawings shall be accessible offline via mobile devices.

7. File Sharing:

    a. Integrated file sharing tool (FTP) to transfer any miscellaneous files such as BIM and CAD files.
    b. Access permissions (view/edit) at a folder level.

8. Punch List and other Field Task Management:

    a. Unlimited customizable field task types including punch list.
    b. Locate and assign tasks from a mobile device.
    c. No additional fees to individual users to access mobile apps.
    d. Data shall be accessible offline on mobile devices.

PART 3 - EXECUTION (Not Used)

END OF SECTION

# Request for Information

**Project:**
[Project Name]

**Project No.:**
[Number]
**RFI No.:**
[Number]
**Date Sent:**
[Date]
**Date Initiated:**
[Date]
**Date Response Requested:**
[Date]

[Name]
**Sender**

[Name]
**Receiver**

[Name]
**Copies to**

## Subject:
[Subject]

## Request:
[Request]

## Senders Proposed Answer/Solution:
[Answer/Solution]

THE PROPOSED ANSWER/SOLUTION ☐IS, ☐IS NOT, INCLUDED IN THE CONTRACT.

## Receivers Response:
[Response]

| [Name] | [Name] | [Name] |
|---|---|---|
| **Sender** | **Sender** | **Sender** |

## Distribution:
[Names]

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 01 3200

# CONSTRUCTION PROGRESS DOCUMENTATION

## PART 1 - GENERAL

### 1.1 SUMMARY

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

### 1.2 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. Major Area: A story of construction, a separate building, or a similar significant construction element.

C. Milestone: A key or critical point in time for reference or measurement.

### 1.3 SUBMITTALS

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

1. PDF electronic file.

B. Startup construction schedule.

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

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

E. Daily Construction Reports: Submit at weekly intervals.

F. Material Location Reports: Submit at monthly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

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

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. 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. 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.
2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
3. Startup and Testing Time: Include no fewer than 7 days for startup and testing.
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 (where applicable), and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Products Ordered in Advance: Include a separate activity for each product.
4. Owner-Furnished Products: Include a separate activity for each product.
5. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing construction.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Partial occupancy before Substantial Completion.
e. Use of premises restrictions.
f. Provisions for future construction.
g. Seasonal variations.
h. Environmental control.

6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Purchases.
d. Mockups.
e. Fabrication.
f. Sample testing.
g. Deliveries.
h. Installation.
i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Building flush-out.
m. Startup and placement into final use and operation.

7. Construction Areas: 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.

8. Other Constraints include but are not limited to the following:

a. Roads.
b. Parking.
c. Landscape.

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

E. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within 14 days of date established for the Notice of Award.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (BAR CHART/GANTT CHART)

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

B. Material Location Reports: At monthly 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.

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 one 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, 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 monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week 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.

3.2 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take electronic construction photographs.

B. Minimum Digital Camera Resolution: 1800 x 1200 dpi (dots per inch) @ 72 dpi resolution.

C. Acceptable Electronic File Format: .jpg, .tif., .tiff., .tga., jpe., or .png.

D. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.

E. Image File Naming Convention (separate by an underscore _ ):

1. Project Job Number / Year-Month-Day / Image Number . file extension

F. Print Format: 8 in (200 mm) by 10 in (250 mm) smooth surface matte prints on single-weight commercial-grade stock, mounted on linen or card stock to allow a 1 in (25 mm) wide margin and enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.

G. Print Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:

1. Name of Project.
2. Name and address of photographer.
3. Name of Architect.
4. Name of Contractor.
5. Date photograph was taken.
6. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

H. Preconstruction Photographs: Before starting construction, take 4 photographs of Project site and surrounding properties from different vantage points, as directed by Architect. Show existing conditions adjacent to property. Submit prints and CD ROMs with digital files as required under "Submittals" Article.

I. Periodic Construction Photographs: Take 4 photographs monthly, coinciding with cutoff date associated with each Application for Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken. Submit prints and CD ROMs with digital files as required under "Submittals" Article.

1. Field Office Prints: In addition to prints required to be submitted under "Submittals" Article, make and retain in field office at Project site available at all times for reference, one set of prints of periodic construction photographs. Identify photographs the same as for those submitted to Architect.

J. Final Completion Construction Photographs: Take 8 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points. Submit prints and CD ROMs with digital files as required under "Submittals" Article.

END OF SECTION

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

B. Digital Signature: A digital signature or digital signature scheme is a mathematical scheme for demonstrating the authenticity of a digital message or document.

C. Electronic Signature: An electronic signature is any legally recognized electronic means that indicates that a person adopts the contents of an electronic message.

D. Informational Submittals: Written and graphic information other than action submittals that require Architect's review. Architect's responsive action is required on informational submittals that do not comply with the information given and design concept expressed in the Drawings and Specifications.

E. 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.

1.3 SUBMITTALS

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

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal category: Action; informational.
   d. Name of subcontractor.
   e. Description of the Work covered.
   f. Scheduled date for Architect's final release or approval.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: If approved by Owner, Architect will furnish Contractor one set of digital data files of Drawing files for use in preparing submittals. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

   1. Distribution: Digital data files shall only be distributed via the HKS Thru site with acceptance of HKS data licensing agreement.

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. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

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

C. Processing Time: Allow sufficient and reasonable time for submittal review, including time for resubmittals. 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. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review.

D. Paper Submittals: Architect reserves the right to require paper submittals.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

   1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
   2. Name file with submittal number, including revision identifier.

a. File Naming Convention (separate by dashes - or underscores _ ):

1) Specification Number / Revision Number / Submittal Sequence (A, B, C, etc.).pdf

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:

a. Project name.
b. Date.
c. Name and address of Architect.
d. Name of Contractor.
e. Name of firm or entity that prepared submittal.
f. Names of subcontractor, manufacturer, and supplier.
g. Category and type of submittal.
h. Submittal purpose and description.
i. Specification Section number and title.
j. Specification paragraph number or drawing designation and generic name for each of multiple items.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Related physical samples submitted directly.
n. Indication of full or partial submittal.
o. Transmittal number, numbered consecutively.
p. Submittal and transmittal distribution record.
q. Other necessary identification.
r. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

a. HKS Job Number and Add Service Number (e.g. 14424.000)
b. Project name.
c. Number and title of appropriate Specification Section.
d. Manufacturer name.
e. Product name.
f. Submittal revision number.

6. Utilize electronic project management software program to process submittals when feasible with the type and extent of submittals. Refer to Division 01 Section "Project Management and Coordination" for description of electronic project management software.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On page, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in file name and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with notation from Architect's action stamp not requiring additional submittals.

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

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with appropriate notation from Architect's action stamp indicating for construction. Retain a separate copy for Owner to be delivered to Owner with Project Closeout documents.

## 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. Submit electronic submittals as PDF electronic files directly to Architect's Project Web site specifically established for Project.

   a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   b. Provide PDF electronic files from scanned paper originals at 300 dpi, minimum.

2. 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. When one or more individual Specification Sections includes requirements for notarized signature on certificates and certifications, provide a notarized statement on original paper copy certificates and certifications where indicated.

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 written recommendations.
   b. Manufacturer's installation instructions.

c. Mill reports.
d. Standard product operating and maintenance manuals.
e. Certification that products are appropriate for installation indicated.
f. Manufacturer's catalog cuts.
g. Manufacturer's product specifications.
h. Standard color charts.
i. Statement of compliance with specified referenced standards.
j. Testing by recognized testing agency.
k. Application of testing agency labels and seals.
l. Notation of coordination requirements.
m. 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.
6. Submit Product Data in the following format:

a. PDF electronic file.

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. Dimensions.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Design calculations.
i. Schedules.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.
m. Relationship and attachment to adjoining construction clearly indicated.
n. Seal and signature of professional engineer.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (212 by 275 mm), but no larger than 30 by 42 inches (750 by 1050 mm).
4. Submit Shop Drawings in the following format:

a. PDF electronic file.

5. BIM File Incorporation: When applicable, develop and incorporate Shop Drawing files into Building Information Model established for Project.

   a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
   b. Refer to Division 01 Section "Project Management and Coordination" for requirements for coordination drawings.

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. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record. This is in addition to physical samples.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

   a. Number of Samples: Submit 4 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

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

a. Number of Samples: Submit 4 sets of Samples. Architect will retain 2 Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

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 4 sets of paired units that show approximate limits of variations.

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

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

G. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

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

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

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

K. Sustainable Construction Submittals: Where applicable, comply with requirements specified in Division 01 sustainable construction requirements Section.

L. 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.

M. 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.

N. 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.

O. 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.

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

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

R. 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.

S. 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.

T. 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.

U. 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.

V. 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.

W. 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.

X. 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-ENGINEERING 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-Engineering Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three 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.

C. BIM File Incorporation: Where applicable, incorporate delegated-design drawing and data files into Building Information Model established for Project.

1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

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 Division 01 Section "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 submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp and mark submittal appropriately, as follows:

1. Final but Restricted Release: When submittals are marked "Accepted as Noted," the Work covered by the submittal may proceed provided it complies with both the Architect's notations and corrections on the submittal and requirements of the Contract Documents. Final acceptance will depend on that compliance.
2. Returned for Resubmittal: When submittal is marked "Revise Resubmit," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Architect's notations. Resubmit without delay. Repeat if necessary to obtain a different action mark.

   a. Do not permit submittals marked "Revise Resubmit" to be used at the Project site, or elsewhere where construction is in progress.
3. Submittals Not Required: Where a submittal is primarily for other Contractor activity, the submittal will be returned, marked "Not Reviewed; Submittal not required by Contract Documents".

B. Architect's acceptance of Shop Drawings, Samples or Product Data which deviates from the Contract Documents does not authorize changes to the Contract Sum. Submit in writing at the time of submission any changes to the Contract Sum affected by such Shop Drawings, Samples or Product Data, otherwise, claim for extras will not be considered.

C. Informational Submittals: Architect will review submittal, and return it in accordance with submittal Processing Time indicated if it does not comply with requirements. Architect will stamp and mark submittal appropriately.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect. Review shall not be final until complete submittal has been reviewed by Architect.

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

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

G. Electronic File of Submittal Documents: Provide Architect with an independent electronic archive of project submittal documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination".

END OF SECTION

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EL PASO, TEXAS

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 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.

1.2 DEFINITIONS

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

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

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are 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. Mockups establish the standard by which the Work will be judged.

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 (Nationally Recognized Testing Laboratories), an NVLAP (National Voluntary Laboratory Accreditation Program), 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 in referring to a trade or entity does not require 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 and with the qualification requirements of individual specification section governing their work.

1.3 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 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.

C. If work is required in a manner that makes it impossible to produce such work of the quality required by or reasonably inferred from the Contract Documents, or should discrepancies appear among the Construction Documents, the Contractor shall request in writing an interpretation from the Architect before proceeding with the work. If the Contractor fails to make such request, no excuse will be entertained thereafter for failure to carry out work in the required manner or to produce required guarantees, warranties, or bonds, and the Contractor shall not be entitled to any change in the Contract Sum or the Contract Time on account of such failure.

1.4 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may be the Project superintendent or be an individual with no other Project responsibilities, as accepted by the Architect.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, 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, including tests and inspections indicated to be performed by the Commissioning Authority when Commissioning is included in the Project.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results, including Owner acceptance of nonconforming work. 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.

## 1.5 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 whether conditions, products, and installation will affect warranty.
7. Statement whether conditions, products, and installation exceed manufacturer's statements.
8. 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 whether 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.

1.6 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. 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 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, mockups, and laboratory 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. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components, attachments to building structure, and requirements of installation.

2. Clean exposed faces of mock-up.
3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Protect accepted mock-up from the elements with weather-resistant membrane.
6. Obtain Architect's acceptance of mock-ups before starting fabrication.
7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
8. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

## 1.7 QUALITY CONTROL

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

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

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. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
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. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

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

D. 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. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
5. 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.

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.

a. 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.

1.8 SPECIAL TESTS AND INSPECTIONS

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

1. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. 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.
3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Retesting and reinspecting corrected work.

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 in a manner that eliminates evidence of patching. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "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

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EL PASO, TEXAS

SECTION 01 4200

REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

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

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

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

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

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

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

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

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

I. Submitted: The terms "submitted", "reported", "satisfactory" and similar words and phrases means submitted to Architect, reported to Architect and similar phrases.

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

1.2 INDUSTRY STANDARDS

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

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

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

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

1.3 ABBREVIATIONS AND ACRONYMS

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

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

IAPMO International Association of Plumbing and Mechanical Officials
www.iapmo.org

ICC International Code Council
www.iccsafe.org

ICC-ES ICC Evaluation Service, Inc.
www.icc-es.org

UBC Uniform Building Code
(See ICC)

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE Army Corps of Engineers
www.usace.army.mil

CPSC Consumer Product Safety Commission
www.cpsc.gov

DOC Department of Commerce
www.commerce.gov

DOD Department of Defense
http://.dodssp.daps.dla.mil

DOE Department of Energy
www.energy.gov

EPA Environmental Protection Agency
www.epa.gov

FAA Federal Aviation Administration

www.faa.gov

FCC Federal Communications Commission
www.fcc.gov

FDA Food and Drug Administration
www.fda.gov

GSA General Services Administration
www.gsa.gov

HUD Department of Housing and Urban Development
www.hud.gov

LBL Lawrence Berkeley National Laboratory
www.lbl.gov

NCHRP National Cooperative Highway Research Program
(See TRB)

NIST National Institute of Standards and Technology
www.nist.gov

OSHA Occupational Safety & Health Administration
www.osha.gov

PBS Public Buildings Service
(See GSA)

PHS Office of Public Health and Science
www.osophs.dhhs.gov/ophs

RUS Rural Utilities Service
(See USDA)

SD State Department
www.state.gov

TRB Transportation Research Board
http://gulliver.trb.org

USDA Department of Agriculture
www.usda.gov

USPS Postal Service
www.usps.com

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG Americans with Disabilities Act (ADA)

| | |
|---|---|
| | Architectural Barriers Act (ABA)<br>Accessibility Guidelines for Buildings and Facilities<br>Available from U.S. Access Board<br>www.access-board.gov |
| CFR | Code of Federal Regulations<br>Available from Government Printing Office<br>www.gpoaccess.gov/cfr/index.html |
| DOD | Department of Defense Military Specifications and Standards<br>Available from Department of Defense Single Stock Point<br>http://dodssp.daps.dla.mil |
| DSCC | Defense Supply Center Columbus<br>(See FS) |
| FED-STD | Federal Standard<br>(See FS) |
| FS | Federal Specification<br>Available from Department of Defense Single Stock Point<br>http://dodssp.daps.dla.mil<br><br>Available from Defense Standardization Program<br>www.dps.dla.mil<br><br>Available from General Services Administration<br>www.gsa.gov<br><br>Available from National Institute of Building Sciences<br>www.wbdg.org/ccb |
| FTMS | Federal Test Method Standard<br>(See FS) |
| MIL | (See MILSPEC) |
| MIL-STD | (See MILSPEC) |
| MILSPEC | Military Specification and Standards<br>Available from Department of Defense Single Stock Point<br>http://dodssp.daps.dla.mil |
| UFAS | Uniform Federal Accessibility Standards<br>Available from Access Board<br>www.access-board.gov |

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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UMC EL PASO CHILDREN'S HOSPITAL
8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 01 5000

# TEMPORARY FACILITIES AND CONTROLS

## PART 1 - GENERAL

### 1.1 SUMMARY

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

### 1.2 USE CHARGES

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

1. Cost or use charges for temporary facilities are not chargeable to Owner or Architect.

B. Sewer Service: Pay sewer-service use charges for sewer usage, indicated by utility company meter readings, by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used, indicated by utility company meter readings, by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used, indicated by utility company meter readings, by all entities for construction operations.

### 1.3 INFORMATIONAL SUBMITTALS

A. Site Plan: Show required contractor temporary office square footage, staging areas, and parking areas for construction personnel.

B. Dust- and HVAC-Control Plan at Renovation Work: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

### 1.4 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6 "Requirements for Demolition Operations", NECA's "Temporary Electrical Facilities," and NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations".

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.

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

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

D. Accessible Temporary Egress at Renovation Work: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

E. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to, the following:

1. Building Code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, Fire Department and Rescue Squad rules.
5. Environmental protection regulations.
6. City ordinances and regulations.

1.5 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. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

C. Chain-Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (42 mm) OD top rails.

D. Portable Chain-Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (40 mm) OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.

E. Wood Enclosure Fence: Plywood, 8 feet (2.4 m) high, framed with four 2 by 4 inch (50 by 100 mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.

F. Polyethylene Sheet: Reinforced, fire-resistive sheet, 6 mil (0.14 mm) minimum thickness, with Class A flame-spread rating per ASTM E 84 and passing NFPA 701 Test Method 2.

1. Basis of Design (Product Standard): Abatement Technologies, Inc.; SAFE-FLEX ICRA Awareness Barrier.

G. Dust Containment Barrier for Doors: reinforced, fire-resistive polyethylene sheet, 10 mil (0.25 mm) minimum thickness with Class B flame-spread rating per ASTM E 84 and designed to be used for securing temporary construction doors so as to minimize and mitigate particle control during construction.

1. Basis of Design (Product Standard): Abatement Technologies, Inc.; Aire Guardian Door Guard Reusable Barrier.

H. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (900 by 1500 mm).

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

2.2 TEMPORARY FACILITIES

A. 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.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

B. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.

C. 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.

D. Air-Filtration Units for Renovation Work: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

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

3.2 TEMPORARY UTILITY INSTALLATION

A. 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. Existing Toilets in Occupied Facilities: Owner will designate existing toilet for construction use.

B. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

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

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

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

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

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

G. Electronic Communication Service: Provide internet access of not less than 15-Mbps download and 5-Mbps upload speed 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. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
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. Parking: Coordinated parking with Owner's requirements.

C. Project Signs: Coordinated signs with Owner's requirements and requirements of authorities having jurisdiction.

D. Comply with progress cleaning requirements in Division 01 Section "Execution."

E. Existing Stair Usage in Occupied Facilities: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

F. Existing Elevator Use in Occupied Facilities: Use of Owner's existing service elevator will be permitted, provided the elevator is cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevator to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

1. Do not load elevator beyond its rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevator becomes damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

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

C. Temporary Enclosures: Provide temporary, weathertight, enclosures for protection of construction, in progress and completed, including, but not limited to, vertical and horizontal openings, from exposure, foul weather, other construction operations, and similar activities.

D. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6 mil (0.14 mm) polyethylene sheet on each side. Cover floor with two layers of 6 mil (0.14 mm) polyethylene sheet, extending sheets 18 inches (450 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

   a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1200 mm) between doors. Maintain walk-off mats in vestibule, for dust control.

3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

E. 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 and authorities having jurisdiction; manage fire-prevention program.

## 3.5 OPERATION, TERMINATION, AND REMOVAL

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

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

1. If temporary facilities are needed, 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.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

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# SECTION 01 6000

# PRODUCT REQUIREMENTS

## PART 1 - GENERAL

### 1.1 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.

### 1.2 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 submittal 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. Substitutions: Changes in products, materials, and equipment from those required by the Contract Documents and proposed by Contractor. Refer to Division 01 Section "Substitution Procedures".

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "Product Standard," 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 other manufacturers

D. Hazardous Substances Prohibited by Law: Including, but not limited to, any product, material, element, constituent, chemical, substance, compound, or mixture, which is defined in, included under, or regulated by any environmental laws.

E. Environmental Laws: Applicable local, state, and federal laws, rules, ordinances, codes, regulations, and requirements in effect at the time Contractor's services are rendered, any amendments for Contractor's services rendered after the effective date of any such amendments.

1.3 SUBMITTALS

A. Comparable Product: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements. 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.

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

C. Contractor shall submit an affidavit on construction company letterhead signed by an officer of the company, notarized by a notary public, which certifies compliance with the environmental laws controlling hazardous substances for the construction of this Project.

1.4 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.

B. Compliance: Contractor shall take whatever measures deemed necessary to insure that all employees, suppliers, vendors, fabricators, subcontractors, or their assigns, to comply with hazardous substance requirements.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft 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 ensure compliance with the Contract Documents and to ensure 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.

1.6 PRODUCT WARRANTIES

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

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product, required by the Contract Documents to provide specific rights for Owner, and specifically endorsed by manufacturer to Owner.
2. Warranties: Prepare a written document, on manufacturer's standard form, modified to include Project-specific information, that contains appropriate terms and identification, properly executed.

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

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, 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. Products and materials brought onto the Project Site, and products and materials incorporated into the Work, shall comply with environmental laws.

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 (Acceptable Manufacturers/Fabricators and Products): 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 be considered unless otherwise indicated.
b. Nonrestricted List (Available Manufacturers/Fabricators and Products): 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 (Acceptable Manufacturers/Fabricators): 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 be considered unless otherwise indicated.
b. Nonrestricted List (Available Manufacturers/Fabricators): 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 (Product Standard): 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, or unnamed manufacturer's product.

C. Descriptive Specification Requirements: Where Specifications describe a product, or assembly, listing exact characteristics required, without use of a brand or trade name, provide a product, material or assembly that provides the characteristics and otherwise complies with Contract requirements.

D. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product or material is specified for a specific application.

1. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.

E. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with imposed code, standard or regulation, select product that complies with standards, codes or regulations specified.

F. Visual 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 Section "Substitution Procedures" for proposal of product.

G. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's color, gloss, pattern, density, or texture" or similar phrase, select a product (and manufacturer) that complies with other specified requirements.

1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
2. Custom Range: Where Specifications include the phrase "custom range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
3. Special Custom Range: Where Specifications include the phrase "special custom range of colors patterns, textures" or similar phrase, Architect will select a new color, pattern, or texture different from those normally produced by the manufacturer.

H. Allowances (If Applicable): Refer to provisions of individual Specification Sections and of Division 01 Section "Allowance" for allowances that control product selection and for procedures required for processing such selections.

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

3.1 RESTRICTION OF HAZARDOUS SUBSTANCES

A. Contractor agrees that it shall not knowingly after reasonable diligence and effort, incorporate into the Work any hazardous substance other than as may be lawfully contained within products, except in accordance with applicable environmental laws. Further, in performing any of its obligations hereunder, Contractor shall not cause any release of hazardous substances into, or contamination of, the environment, including soil, the atmosphere, any watercourse or ground water, except in accordance with applicable environmental laws. In the event that Contractor engages in any of the activities prohibited in this paragraph, to the fullest extent permitted by law, Contractor hereby indemnifies and holds harmless Owner and its partners, members, officers, directors, agents, employees and consultants from and against any and all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorney's fees, arising out of, incidental to or resulting from the activities prohibited.

B. In the event Contractor observes on the Project Site any substance which Contractor reasonably believes to be a hazardous substance, and which is being introduced into the Work, or exists on the Project Site, in a manner violative of any applicable environmental laws, Contractor shall immediately notify Owner and report the condition to Owner in writing. The Work in the affected area shall not thereafter be resumed except by written authorization of Owner if in fact a hazardous substance has been encountered and has not been rendered harmless. In the event that Contractor fails to give Owner proper notification hereunder, upon knowingly observing a hazardous substance at the Project Site, to the fullest extent permitted by the law, Contractor hereby indemnifies and holds harmless Owner, and all of its partners, members, officers, directors, agents, employees and consultants from and against all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorneys' fees, arising out of, incidental to, or resulting from Contractor's failure to stop the Work.

C. If Owner believes that hazardous substances may have been located, generated, manufactured, used or disposed of on or about the Project Site by Contractor or any of its employees, agents, subcontractors, suppliers, or invitees, Owner may have environmental studies of the Project Site conducted as it deems appropriate, and Contractor shall be responsible for the cost of such studies to the extent that Contractor or any of its employees, agents, subcontractors, suppliers or invitees are responsible for the presence of any hazardous substances.

END OF SECTION

# SECTION 01 7300

# EXECUTION

## PART 1 - GENERAL

### 1.1 SUMMARY

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

1. Installation of the Work.
2. Cutting and patching.
3. Coordination of Owner-installed products.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

### 1.2 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.

### 1.3 SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

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

1. Structural Elements: 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.
3. Miscellaneous 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.
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 on the exterior or in occupied spaces 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.

a. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

B. 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.

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

1.5 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 sustainable construction requirements Section.

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: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions. 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.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

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

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Existing Utility Interruptions at Renovation Work: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

C. 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.

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

E. 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 Section "Project Management and Coordination."

3.4 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, unless indicated otherwise in the Contract Documents.

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, aligned, and coordinated 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.

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.

3.5 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 Division 01 Section "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 prevent 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. 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.
5. 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.
    b. Patch fire rated assemblies with materials to match existing and maintain assembly fire rating.

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.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: As applicable, 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. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. 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 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

   a. Use containers specifically intended for holding types of waste materials indentified where applicable, e.g. blue colored containers with labeling and symbols for bio-waste.

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 immediately.
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 in Division 01 Section "Temporary Facilities and Controls.".

H. Remove construction markings not required and graffiti immediately, repairing or replacing damaged material.

I. 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.

J. 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.

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

3.8 STARTING AND ADJUSTING

A. As applicable, coordinate startup and adjusting of equipment and operating components with commissioning requirements in Division 01 specification sections.

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

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

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

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

3.9 PROTECTION OF INSTALLED CONSTRUCTION

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

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

END OF SECTION

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EL PASO, TEXAS

SECTION 01 7700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

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

1.2 SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

C. Certificates of Release: From authorities having jurisdiction.

D. Certificate of Insurance: For continuing coverage.

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

1.3 SUBSTANTIAL COMPLETION PROCEDURES

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

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

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

   a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.

5. Submit test/adjust/balance records.

C. Procedures Prior to Substantial Completion: Complete the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial. 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, in writing, 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.

E. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

1.4 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 Division 01 Section "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). 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.

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

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

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

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

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

4. Submit list of incomplete items in the format agreed upon by the Owner and Architect.

1.6 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within minimum number days, as required by the Contract, of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

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

1. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

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

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

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
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. Remove all graffiti and construction writing.
m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
r. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls.".

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

3.2 REPAIR OF THE WORK

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

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

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that 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 all lamps and starters to comply with requirements for new fixtures.

C. All Warranties remain in effect.

END OF SECTION

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EL PASO, TEXAS

SECTION 01 7823

# OPERATION AND MAINTENANCE DATA

## PART 1 - GENERAL

### 1.1 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.

### 1.2 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.

### 1.3 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.

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

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Owner.

   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. 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 and before commencing demonstration and training. Architect will return copy with comments.

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

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

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. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. 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.

## 2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

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

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.

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

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

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

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

## 2.5 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.

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

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

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

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 Section "Project Record Documents."

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

END OF SECTION

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EL PASO, TEXAS

SECTION 01 7839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 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. Miscellaneous record submittals.

1.2 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit PDF electronic files of scanned record.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit-annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 ELECTRONIC PROJECT MANAGEMENT SOFTWARE

A. Electronic File of Project Record Documents: Provide Architect with an independent electronic archive of accepted project record documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination", in addition to the printed documents described elsewhere in this Section.

2.2 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.

2.3 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. Note related Change Orders, record Product Data, and record Drawings where applicable.

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

2.4 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 record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

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

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 scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

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

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EL PASO, TEXAS

SECTION 01 7900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 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.

1.2 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.

B. Qualification Data: For instructor.

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

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "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.

1.4 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 emergency, operation, and maintenance manuals.

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 Section "Operations 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.

1. Owner will furnish Contractor with names and positions of participants.

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 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 remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION

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EL PASO, TEXAS

SECTION 02 4119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes selective removal and subsequent offsite disposal of portions of existing building indicated on drawings and as required to accommodate new construction.

1.2 DEFINITIONS

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

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner's designated storage area.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.4 INFORMATIONAL SUBMITTALS

A. 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.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of temporary partitions and means of egress.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

C. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

1.5 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Professional Engineer Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for demolitions similar to this Project and has a record of successful in-service performance

C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Comply with applicable regulations, codes and ordinances.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Proposed Dust-Control and Noise-Control Measures: Written statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

F. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:

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.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.6 PROJECT CONDITIONS

A. Occupied Buildings:

1. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
2. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

B. Owner assumes no responsibility for condition of areas to be selectively demolished. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.

C. Hazardous Materials: If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Storage or sale of removed items or materials on-site will not be permitted.

E. 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.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.

1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Occupied Buildings: Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.

1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.

C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

1. Arrange with Owner to shut off indicated utilities.
2. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.3 PREPARATION

A. 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. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
3. Protect existing site improvements, appurtenances, and landscaping to remain.

B. Temporary Facilities: 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 furnishings, and equipment that have not been removed.

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

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

D. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

E. Temporary Shoring: Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished. Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS

A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

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.
3. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
4. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
5. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, verify condition and contents before starting flame-cutting operations.
6. Maintain portable fire-suppression devices during flame-cutting operations.
7. Maintain adequate ventilation when using cutting torches.
8. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
9. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

10. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
11. Dispose of demolished items and materials promptly.
12. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

C. Removed and Salvaged Items: Comply with the following:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items: Comply with the following:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
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 reinstalled in their original locations after selective demolition operations are complete.

## 3.6 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

1. Completely fill holes and depressions in existing concrete or masonry that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.

## 3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Refer to the drawings.

END OF SECTION

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EL PASO, TEXAS

SECTION 03 0150

CONCRETE PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes non-structural concrete patching and supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTALS

A. Product Data: Submit copies of manufacturers' technical literature for specified products. Submittal(s) shall identify location(s) of Contractor's intended application of product(s).

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer(s) Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

B. Fire Rated Assemblies: Perform patching of fire rated assemblies using materials and procedures to maintain fire rating of existing assembly.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply patching and repair material when air and substrate temperatures are outside limits permitted by manufacturer.

B. Hot-Weather Requirements: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as recommended by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 MATERIALS, GENERAL

A. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

2.3 MATERIAL

A. Epoxy-Resin Bonding Adhesives: ASTM C 881, Type II.

1. Suitable for use on dry or damp surfaces.
2. Epoxy Adhesive for Bonding Plastic Concrete to Hardened Concrete: Conform to requirements of ACI 503.2-92 (R97), unless modified herein.
3. Epoxy Adhesive for Bonding Hardened Concrete, Steel, Wood, Brick, and other Materials to Hardened Concrete: Conform to requirements of ACI 503.1-92 (R97), unless modified herein.
4. Manufacturers:

a. BASF
b. Euclid Chemical Company
c. Sika Corporation
d. W.R. Meadows

B. Latex Bonding Agents, Admixtures, and Adhesives: ASTM C 1059, Type II.

1. Acceptable at non-structural and structural bonding applications, interior or exterior, unless noted otherwise in Contract Documents.
2. Use only acrylic or styrene butadiene latex based adhesives.
3. Manufacturers and Products:

a. Euclid Chemical Company; SBR Latex
b. L & M Construction Chemicals; Everbond
c. W.R. Meadows, Inc.; ACRY-LOK

C. Polyvinyl Acetate Bonding Agents: ASTM C 1059, Type I.

1. Acceptable at non-structural and structural bonding applications, interior surfaces not subject to water exposure or high humidity during construction or in-service.
2. Manufacturers and Products:

a. Euclid Chemical Company; Euco Weld.
b. L & M Construction Chemicals; Everweld.
c. W.R. Meadows, Inc.; Intralok.

D. Patching Mortar: Packaged, dry mix polymer-modified, cementitious patching mortar complying with ASTM C 928 that contains a non-redispersible latex additive as either a dry powder or a separate liquid that is added during mixing.

E. Coarse Aggregate: Washed aggregate complying with ASTM C 33, Size No. 8, Class 5S. Add only as permitted by patching mortar manufacturer.

F. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.

G. Self-Leveling Concrete Underlayment - Non-traffic-bearing:

1. Description: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 in (3 mm) to 1 in (25 mm) and that can be feathered at edges to match adjacent floor elevations. Interior use only, unless exterior application recommended by manufacturer within written literature.
2. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
3. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
4. Aggregate: Well-graded, washed sand as recommended by underlayment manufacturer.
5. Compressive Strength: 4,000 psi minimum at 28 days when tested according to ASTM C 109.
6. Substrate Preparation: As recommended by product manufacturer.
7. Basis of Design (Product Standard): Ardex, Inc.; "Ardex K-15".
8. Manufacturers: (Consult manufacturer for specific product and compatibility with substrate conditions. Subject to Architect'¢¢s and Engineer'¢¢s review and approval.)

    a. Ardex, Inc.
    b. BASF
    c. Euclid Chemical Co.

H. Self-Leveling Concrete Topping - Traffic-bearing:

1. Description: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/2 in (12 mm) to 2 in (50 mm). Consult manufacturer for thickness exceeding 2 in (50 mm). Interior use only, unless exterior application recommended by manufacturer within written literature.
2. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
3. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
4. Aggregate: Well-graded, washed gravel, 1/8 in (3 mm) to 3/8 in (10 mm) or coarse sand as recommended by topping manufacturer for specific application thickness. No coarse aggregate permitted for thicknesses of 1 in (25 mm) or less.
5. Compressive Strength: 5,000 psi minimum at 28 days when tested according to ASTM C 109.
6. Substrate Preparation: As recommended by product manufacturer.
7. Basis of Design (Product Standard): Ardex Inc.; "Ardex SD-T".
8. Manufacturers: (Consult manufacturer for specific product and compatibility with substrate conditions. Subject to Architect'¢¢s and Engineer'¢¢s review and approval.)

a. Ardex, Inc.
b. BASF
c. Euclid Chemical Co.
d. Sika Corp.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Concrete Removal: Saw-cut perimeter of areas indicated for removal to a depth of at least 1/2 in (12 mm). Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcing. Remove loose and deteriorated concrete.

C. Preparation of Floor Joints: Saw-cut joints full width to edges of spalls and to a depth of at least 3/4 in (19 mm). Clean out debris and loose concrete; vacuum or blow clear with compressed air.

D. Surface Preparation for Patching Mortar: Clean concrete by scarifying or sand blasting to remove dirt, oils, films, and other materials detrimental to patching application. Allow surface to dry before applying mortar.

E. Surface Preparation for Toppings: Remove delaminated material and deteriorated concrete surface material. Roughen surface of concrete by shot blasting, to produce a surface profile recommended by manufacturer. Sweep and vacuum roughened surface to remove debris followed by low-pressure water cleaning.

3.4 APPLICATION

A. Epoxy Bonding Agent: Apply to reinforcing bars and concrete by brush, roller, or spray according to manufacturer's written instructions, leaving no pinholes or other uncoated areas. Apply to reinforcing bars in at least two coats, allowing first coat to dry before applying second coat. Apply patching mortar or concrete while epoxy is still tacky. If bonding agent dries, recoat before placing patching mortar or concrete.

B. Latex Bonding Agent, Type II: Mix with Portland cement and scrub into concrete surface according to manufacturer's written instructions. If bonding agent dries, recoat before placing patching mortar or concrete.

C. Latex Bonding Agent, Type I: Apply to concrete by brush roller or spray. Allow to dry before placing patching mortar or concrete.

D. Patching Mortar: Unless otherwise recommended by manufacturer, apply as follows:

1. Wet substrate thoroughly and then remove standing water. Scrub slurry of neat patching mortar into substrate, filling pores and voids.
2. Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
3. For vertical patching, place material in lifts of not more than 1 in (25 mm) or less than 1/4 in (6 mm). Do not feather edge.
4. For overhead patching, place material in lifts of not more than 1/2 in (12 mm) or less than 1/8 in (3 mm). Do not feather edge.
5. After each lift is placed, consolidate material and screed surface.
6. Where multiple lifts are used, score surface of lifts to provide a rough surface for application of subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.
7. Allow surfaces of lifts that are to remain exposed to become firm and then finish to match adjacent surface.
8. Wet-cure cementitious patching materials, including polymer-modified, cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.

E. Epoxy Joint Filler: Install in nonmoving floor joints where indicated.

1. Install filler to a depth of at least 1 in (25 mm). Use fine silica sand no more than 1/4 in (6 mm) deep to close base of joint. Do not use sealant backer rods or compressible fillers below joint filler.
2. Install filler so that when cured, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.

F. Topping or Underlayment: Mix and apply self leveling components according to manufacturer's written instructions.

1. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
2. Apply to produce uniform, level surface.
3. Add aggregate for thicker areas as recommended by manufacturer.
4. Apply a final layer without aggregate if required to produce smooth surface.

5. Feather edges to match adjacent floor elevations.
6. Cure according to manufacturer's written instructions.
7. Prevent contamination during application and curing processes.
8. For areas which are to have finish flooring, use self-leveling concrete underlayment.
9. For areas which will be exposed as wearing surface, use self-leveling concrete topping.

END OF SECTION

# SECTION 05 12 10 - STRUCTURAL STEEL

## 1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Structural Steel, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

## 1.2 QUALITY ASSURANCE

A. Structural steel work covered herein shall be fabrication and erection of steel framing and bracing members including connections and steel material either supporting or connected to steel members shown on structural plans and not specified in other sections.

B. Quality standards latest edition of the following standards plus any corresponding published revisions at the time of bidding shall be the applicable standard. The Local Building Code shall govern when conflicts occur.
   1. Local Building Code.
   2. American Institute of Steel Construction (AISC):
      a. ANSI/AISC 360 "Specification for Structural Steel Buildings" (referred to herein as the AISC Specification).
      b. Code of Standard Practice for Steel Buildings and Bridges (referred to as AISC Code of Standard Practice).
      c. Quality Certification Program.
   3. American Welding Society:
      a. Structural Welding Code - Steel ANSI/AWS-D1.1 (referred to herein as the AWS Code). The AWS Code shall govern the techniques and quality of welding and testing procedures. Statements contained in the AWS Code requiring information to Bidders and/or Contract Documents to define nondestructive testing or statements defining responsibilities and obligations for services and payment shall be disregarded.
   4. Research Council on Structural Connections: "Specifications for Structural Joints Using High Strength Bolts" (referred to herein as the RCSC Specification).
   5. Steel Structures Painting Council (SSPC): Steel Structures Painting Manual Vol. 2, "System and Specifications" (referred to herein as the SSPC Specification).

C. Qualifications:
   1. Steel fabricator:
      a. Certified by AISC Quality Certification Program for Structural Steel Fabricators and is designated as AISC Certified Fabricator, Standard for Steel Building Structures.
      b. Fabricators not certified shall have minimum 10 years experience and shall employ an approved testing agency to inspect fabrication work performed off site. The testing agency shall furnish weekly inspection reports and a final report to the Building Official and the Architect certifying the work was performed in accordance with the specifications and approved shop drawings.
   2. Steel erector:
      a. Minimum 10 years experience in erection of structural steel.
      b. Certified as Certified Steel Erector by AISC quality Certification Program.

3. Certification by other equivalent programs subject to approval of the Structural Engineer.

D. Source quality control:
1. Provide access and facilities for testing agency during shop and field inspections.

E. Testing and inspection: Testing, (except testing to qualify welders and as needed for Contractor's own quality control), will be performed at no cost to Contractor by a Testing/Inspection Agency employed by Owner. Owner's Testing/Inspection Agency may use nondestructive testing methods in addition to visual inspection to verify weld quality. Repair rejected welds as directed by Testing/ Inspection Agency at no additional cost to Owner.

F. Provide testing and inspection agency with sufficient notification and access so that inspection and testing can be accomplished.

G. Previous acceptance of material or finished members by testing and inspection agency or Architect/Engineer shall not prevent its rejection at later date if it does not comply with specifications.

H. Tolerances:
1. Rolling: ASTM-A6.
2. Fabrication and Erection tolerances: AISC Code of Standard Practice.

I. Complete final design of connections not defined on Contract Documents.
1. Design connections at each end of member for loads (in Kips) noted in parenthesis. If load not indicated, design for capacity of member.
2. Connection arrangement and detail shall be consistent with similar connections where indicated on Contract Documents.
3. Connection design shall satisfy applicable Building Codes and shall use latest approach to design as offered by AISC.

1.3 SUBMITTALS

A. Shop Drawings:
1. Indicate details including cuts, copes, connections, holes and welds. Indicate shop and field welds using AWS symbols. Indicate connections where high strength bolts are required.
2. Headed stud placement drawings.

B. Product Data:
1. Source and certification of quality for high-strength bolts, nuts and washers.
2. Technical data on base plate grout.

C. Project Information:
1. Fabricator's AISC Certification or name of independent testing agency for use by non-certified fabricator along with proof that fabricator has 10 years experience in fabrication of structural steel for buildings.
2. Inspection reports and certification of shop fabrication by independent testing laboratory for non-certified fabricator.
3. Steel erector's AISC Certification or proof that steel erector has 10 years experience in erection of structural steel.
4. Connection design calculations. Design shear and moment connections for loads placed on plans or maximum forces based on column and beam cross-sectional and material properties.
5. Welding Procedure Specification (WPS) for shop and field welds.

D. Contract closeout information:
   1. Certificate by fabricator that steel was fabricated in accordance with the approved construction documents.
   2. Certificate by erector that steel was erected in accordance with the approved erection plans and specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel, structural "W" shapes and tee's: ASTM A992 (50 ksi yield point).

B. Other steel shapes and plate: ASTM A36.

C. Pipe round: ASTM A53, Grade-B.

D. Tubing square or rectangular: ASTM A500, Grade-B ( 46 KSI minimum).

E. Bolts, nuts, and washers, high-strength. Conform to RCSC Specification
   1. Twist off style, conform to ASTM F1852
      a. Approved bolts:
         1) Tension control bolt by LeJeune Bolt Company, Burnsville, MN.
         2) Tru-Tension Fasteners by Nucor Fastener a Division of Nucor Corporation, St. Joe, Indiana.
         3) Lohr Fasteners by Lohr Structural Fasteners, Humble, TX.

F. Bolts, nuts and washers, standard strength:
   1. Bolts: ASTM A307, Type A.
   2. Nuts: ASTM A563.
   3. Washers plain: ANSI/ASME-B18.22.1.

G. Anchor bolts, high-strength:
   1. Bolts or rod for threading: ASTM F1554-105 ksi. meeting supplementary requirement S4. Pretension to load indicated on plans.
   2. Nuts, heavy hex: ASTM-A563.
      a. Up to 1 1/2 IN diameter: Grade D hex
      b. Over 1-1/2 IN diameter: grade DH Heavy Hex.
   3. Washers:
      a. Hardened Steel: ASTM F436 type 1
      b. Load indicator type: Direct Tension Indicating Washers as manufactured by TurnaSure LLC of Langhorne, PA or approved equal, Install per manufacturers recommendations
   4. Thread tolerance: ANSI/ASME-B18.1, Class 2A.

H. Anchor bolts, standard strength:
   1. Bolts or rod for threading: ASTM A36 or ASTM F1554-36 ksi.
   2. Nuts and washers:
      a. Nuts: ASTM A563.
      b. Washers plain: ANSI/ASME-B18.22.1.
   3. Thread tolerance: ANSI/ASME-B18.1, Class 2A.

I. Welding electrodes:
   1. Shielded metal-arc: AWS A5.1 or AWS A5.5, E70XX
   2. .Submerged-arc: AWS A5.17 or A5.23, F7X-EXXX.
   3. Gas metal-arc: AWS A5.18, ER70S-X.

4. Flux cored-arc: AWS A5.20, E70T-X (except 2, 3, 10, GS).

J. Headed studs and deformed bar anchors:
1. Headed studs (HS)
   a. Fabricated form cold drawn bar stock conforming to ASTM A 108, grades 1010 through 1020.
   b. AWS D1.1 type B.
   c. Minimum Yield strength: 51 ksi.
   d. Minimum tensile strength: 65 ksi over 3/8 IN diameter.
   e. Minimum tensile strength: 55 ksi 3/8 IN diameter and under.
2. Deformed anchor bars (DBA): Straight, unless otherwise indicated.
   a. ASTM A496.
   b. Minimum yield strength: 70 ksi.
   c. Minimum tensile strength: 80 ksi.

K. Grout: Pourable.
1. "Duragrout" as manufactured by L&M Construction Chemicals, or equal.
2. Minimum Strength : 4000 PSI at 7 days and 8000 PSI at 28 days.

L. Expansion anchors:
1. Expansion anchors shall be a single-end expansion shield anchor which complies with the descriptive part of Federal Specification FF-S325, Group II, Type 4, Class 1 for concrete expansion anchors. Anchors shall be Hilti Kwik Bolt TZ Expansion anchor by Hilti fastening systems of Tulsa, OK (ICC Report No. ESR-1917) or equal.

M. Adhesive anchors:
1. Threaded rods, bolts, etc., indicated as adhesive anchors into concrete or solid masonry:
   a. HILTI, HIT HY-200 MAX - SD adhesive by Hilti Fastening Systems of Tulsa, OK (ICC Report No. ESR-3013) or equal.
   b. Unless indicated otherwise, adhesive anchor bolt shall conform to HAS - E Standard ISO Class 5.8 by Hilti or equal. Do not field cut rods without engineer's approval.
   c. Hilti

N. Slide bearings at expansion joints:
1. Masticord with teflon slide plates as manufactured by JVI MC., Skokie Illinois, or equal. Size, thickness, and configuration as shown on the drawings. Where no material is detailed the fabricator shall provide slide bearing materials for full bearing area of structural steel with a load equal to the maximum for the steel section.

## 2.2 FABRICATION

A. General:
1. Fabricate and assemble material in shop to greatest extent possible.
2. Use A325 bolts, twist-off type, unless otherwise indicated.
3. One sided or other types of eccentric connections not indicated, will not be permitted without prior approval.
4. Bevels for field welds may be flame cut provided such cutting is done automatically. Leave free of burrs and slag.
5. Grind flush web fillets at webs notched to receive backup plates for flange groove welds.
6. Flame cut edges of stiffener plates at field or shop butt welds. Do not shear.

7. Accurately mill bearing ends of columns.
8. Trusses, beams and girders over 50 FT in length shall be cambered in an amount required by the Architect. Members less than 50 FT in length shall be cambered when indicated on the drawings or otherwise fabricate such that after erection any natural camber due to rolling or assembly is upward.
9. Cut, drill, or punch holes at right angles to surface of metal.
   a. Do not make or enlarge holes by burning.
   b. Make holes clean cut, without torn or ragged edges.
   c. Remove outside burrs resulting from drilling or reaming operations with tool making 1/16 IN bevel.
   d. Provide holes in members to permit connection of work of other trades.
10. Make allowance for draw in of tension bracing.
11. Make splices only as indicated.
12. Headed stud type shear connectors (H.S.) and deformed bar anchors (D.B.A.), on Drawings: Automatically end welded in accordance with AWS Code.
    a. When headed stud type shear connectors are to be either shop or field applied, clean top surface of beam flanges in shop to remove oil, scale, rust, dirt and other materials injurious to satisfactory welding.
    b. Fillet welding of headed studs and deformed anchors is not allowed without prior approval.
    c. Do not weld studs when temperature is below 0 degF or surface is wet with rain or snow.
    d. After welding, remove ceramic ferrules and maintain clean and free from substances which would interfere with function as anchor or bond of deformed anchor bars.
    e. Quality control: Weld minimum of 2 studs at start of each production period to determine proper generator, control unit, and stud welder settings.
       1) These studs shall be capable of being bent 45 degrees from vertical without weld failure. These studs shall not be included as a part of the required construction.
       2) All production studs shall be sounded by a sharp blow with a hammer.
       3) If, after welding, a stud does not ring when struck by a hammer or visual inspection reveals that sound weld or full 360 degree fillet has not been obtained for a particular stud, that stud shall be struck with hammer and bent approximately 15 degrees off perpendicular to nearest end of beam.
       4) Studs meeting this test shall be considered acceptable and shall be left in this position.
       5) Studs bent beyond 15 degrees shall be considered ineffective and replaced.
       6) Studs failing under this test shall be replaced.
       7) Studs final position and height shall be as indicated on construction documents. Erector and Fabricator shall coordinate stud length and welding methods to comply with final stud length specified.

B. Welding:
   1. Welding, techniques of welding employed, appearance and quality of welds, and methods used to correct defective work shall comply with AWS Code, and requirements indicated.
   2. Test and qualify welding operators and tackers in compliance with AWS Code for position and type of welding to which they will be assigned.
      a. Conduct tests in presence of approved testing agency.

b. Certification within last 12 months from a welding inspector will be acceptable provided samples of welder's work are satisfactory.
c. At discretion of testing agency, shop personnel continuously employed at welding process for which they have been qualified may be accepted from older qualification tests.

3. Qualify joint welding procedures or test in accordance with AWS qualification procedures.
4. Before start of welding work, meet with testing agency and welders to review and verify procedures.
5. Comply with AWS Code to minimize shrinkage and distortion stress.
6. Use back-up plates in accordance with AWS Code, extending minimum of 1 IN either side of joint.
7. Make flange welds before making web welds.
8. For manual shielded metal-arc welding: Comply with Article 4.6 of AWS Code.
9. Low hydrogen electrodes: Dry and store electrodes in compliance with AWS Code.
10. Do not perform welding when ambient temperature is lower than 0 degF, or where surfaces are wet or exposed to rain, snow, or high wind, or when welders are exposed to inclement conditions.
11. Before starting welding:
    a. Carefully plumb and align members.
    b. Fully tighten bolts.
    c. Assembly and surface preparation shall comply with AWS Code.
    d. Preheat base metal to temperature stated in AWS Code.
        1) When no preheat temperature is given and base metal is below 32 degF, preheat base metal to at least 70 degF.
        2) Maintain temperature during welding.
        3) Preheating shall bring surface of base metal within distance from point of welding equal to thickness of thicker part being welded or 3 IN, whichever is greater, to specified preheat temperature.
        4) Maintain this temperature during welding.
    e. Each welder is to provide identifying mark at welds worked on.

## 2.3 SURFACE PREPARATION AND SHOP-APPLIED COATINGS

A. Surfaces not to be coated:
1. Do not coat following surfaces:
    a. Surfaces to be fireproofed with spray-on material.
    b. Machined surfaces, surfaces adjacent to field welds, contact surfaces of bolt connections where connection is specified as slip critical, and top of top flanges of beams.
    c. Other members for which no coating is specified.
2. Clean thoroughly before shipping; remove loose mill scale, rust, dirt, oil and grease.

B. Hot-dip Galvanized (HDG) members:
1. Galvanize following members:
    a. Members set in, or in contact with, exterior surface material, including:
        1) Brick ledge angles.
        2) Embedded items in exterior surfaces.
    b. Exterior exposed structure not indicated to be painted in the field.
    c. Other members indicated.
2. Clean thoroughly before galvanizing.
3. Galvanize in accordance with ASTM A123.

## 2.4 SURFACE TREATMENT AND FIELD APPLIED COATINGS

A. Exposed structural steel elements within 15'-0" of finished floor shall be painted with High performance paint in accordance with section 09 96 00
   1. Once coatings are applied to an exposed structural steel element (such as a column), the entire element must be painted with the same paint type or coating.
   2. Powder Coat all steel in direct contact with veneered masonry.

# PART 3 - EXECUTION

## 3.1 ERECTION

A. Safety:
   1. Contractor is solely responsible for safety. Construction means and methods and sequencing of work is the prerogative of the Contractor.

B. Capacity of partially complete construction:
   1. Consider that full structural capacity of many structural members is not realized until structural assembly is complete; That is, until slabs, decks and diagonal braces are installed. Partially complete structural members shall not be loaded out of sequence without an investigation.
   2. Until elements of the permanent lateral bracing system of the structure are complete, temporary lateral bracing for the partially complete structure will be required.

C. Temporary bracing:
   1. Adequate temporary bracing to provide stability and resist loads to which the partially complete structure may be subjected to including construction activities and operation of equipment is the responsibility of the Contractor.
   2. If not obvious from the drawings, confer with the Architect to identify those structural elements that must be complete before the structure's permanent lateral bracing system is effective. The design of the temporary bracing system must consider the sequence and schedule of placement of such elements and effects of loads imposed on the structural steel frame by partially or completely installed work of other trades. Do not remove temporary bracing until the permanent lateral bracing system is effective.

D. General:
   1. Set base and bearing plates accurately and grout immediately as indicated.
      a. Use metal wedges, shims or setting nuts as required.
      b. Pack grout solidly between plate and bearing surface.
   2. Clean bearing and contact surfaces before assembly.

E. Install A325SC bolts with washers. Install and tighten in accordance with the RCSC Specifications or in accordance with manufacturer's instructions when twist-off bolts are used.

F. Field weld as specified in paragraph "Welding."

G. Do not use gas cutting to correct fabrication errors on major members.
   1. Gas cutting on minor members may be permitted when members are not loaded, only after approval by Architect.

H. Tighten and leave in place erection bolts used in welded construction.

I. Provide beveled washers to give full bearing to bolt head or nut where bolts are to be used on surfaces having slopes greater than 1:20 with a plane normal to bolt axis.

J. After installation, touch up damaged or abraded areas of primed steel using same materials used for shop priming.
   1. Clean field welds, bolted connections and abraded areas before touching up.

K. After installation, repair galvanized surfaces damaged or abraded using zinc rich paint in accordance with ASTM A780.
   1. Surfaces to be repaired with paint containing zinc dust shall be clean, dry, and free of oil, grease, preexisting paint, corrosion, and / or rust.
   2. Surfaces to be repaired shall be blast cleaned to the requirements of SPC SP10 (near white). Where circumstances do not allow blast or power tool cleaning to be used, then hand tools may be used. Cleaning shall meet the requirements of SSPC SP2 (removal of loose rust, mil scale, or paint to the degree specified by hand chipping, scraping, sanding and wire brushing)
   3. If the areas /surfaces to be repaired include welds, first remove all weld flux residue and weld spatter by blasting, chipping, grinding, or power scaling.
   4. Spray or brush apply the paints containing zinc dust to the prepared surfaces/areas. Apply the paint in accordance with the manufacturer's recommendations in a single application employing multiple passes to achieve a dry film thickness equal to the original zinc coating thickness.

END OF SECTION

UMC EL PASO CHILDREN'S HOSPITAL
8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 05 5000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Metal fabrications and supplementary items necessary for installation.

1.2 DEFINITIONS

A. Unprotected Areas: Exterior areas directly exposed to the elements such as rain, snow, or ice.

B. Protected Areas: Interior and exterior areas not directly exposed to the elements such as rain, snow, or ice.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer/fabricator's technical literature for each product and system indicated.

1. Include manufacturer/fabricator's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

B. Welding Qualifications: Qualify procedures and personnel according to following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel".
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel".
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel".
4. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer/fabricator. Provide secondary materials only as recommended by manufacturer/fabricator of primary materials.

2.3 FERROUS METAL MATERIALS

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, blemishes, or other imperfections where exposed to view on finished units. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.

1. Marking Systems for Metal Fabrications: Where finished items are exposed to view, use temporary tags attached with wires or other system acceptable to Architect.

B. Steel:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: ASTM A 500, cold-formed steel tubing.
3. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless another weight is indicated or required by structural loads.

4. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
5. Finish:

    a. Unprotected Areas: Galvanized metal.
    b. Protected Areas: Uncoated ferrous metal.
    c. Location: Roof mechanical equipment screen wall.

C. Stainless Steel:

1. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
2. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
3. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 NON-FERROUS METAL MATERIALS

A. Aluminum Plate and Sheet: ASTM B 209/B 209M, Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B 221/B 221M, Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.5 FASTENERS

A. Fastener Type and Material: Select fasteners for type, grade, and class required to produce connections suitable for anchoring fabrications to other types of construction indicated.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307/F 568M, Grade A/ ASTM F 568M, Property Class 4.6; with hex nuts, ASTM A 563/A 563M; and, where indicated, flat washers.

C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593/F 738M; with hex nuts, ASTM F 594/F 836M; and, where indicated, flat washers; and as follows:

1. Protected Areas:

    a. Alloy Group 1 (A1) for Type 304.

2. Unprotected Areas:

    a. Alloy Group 1 (A1) for Type 304.

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563/ A 563M; and, where indicated, flat washers. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Plain Washers: Round carbon steel, ASME B18.22.1/ASME B18.22M.

F. Lock Washers: Helical, spring type carbon steel, ASME B18.21.1/ASME B18.21.2M.

G. Eyebolts: ASTM A 489.

H. Machine Screws: ASME B18.6.3/B18.6.7M.

I. Lag Screws: ASME B18.2.1/B18.2.3.8M.

J. Wood Screws: ASME B18.6.1, flat head, carbon steel.

2.6 ANCHORS

A. General: Provide anchors capable of sustaining, without failure, a load equal to 6 times load imposed when installed in unit masonry and 4 times load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

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

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

1. Protected Areas:

a. Steel: Carbon steel components zinc plated to comply with ASTM B 633 or ASTM F 1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
b. Stainless Steel: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593/F 738M; with hex nuts, ASTM F 594/F 836M; and, where indicated, flat washers; Alloy Group 1 (A1) for Type 304.
c. Locations: Where specified or where indicated on drawings.

2. Unprotected Areas: Stainless steel bolts, ASTM F 593/F 738M, and nuts, ASTM F 594/F 836M; and as follows:

a. Alloy Group 1 (A1) for Type 304.

3. Post-Tensioned Concrete Locations: Anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer'¢s written approval for all proposed anchors in post-tensioned concrete prior to installation.

2.7 PAINT MATERIALS

A. Paint for Steel Fabrications: As specified in Division 09 Section "Painting".

B. Galvanizing Repair Paint for Steel Fabrications in Unprotected Areas: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Bituminous Paint for Aluminum Fabrications: ASTM D 1187, cold-applied asphalt emulsion.

2.8 ACCESSORY ITEMS

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

B. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28 day compressive strength of 3000 psi (210.92 k/cm), unless otherwise indicated.

C. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer/fabricator.

2.9 FABRICATION, GENERAL

A. General: Fabricate metal fabrications, including clips, brackets, and other components necessary to support and anchor fabrications to supporting structure, and to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.

1. Join components by welding unless otherwise indicated.

B. Shop Assembly: Assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces.

C. Fabrication Requirements:

1. Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges to a radius of approximately 1/32 in (0.8 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
2. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
3. Form work true to line and level with accurate angles and surfaces and straight sharp edges.
4. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
5. Unprotected Areas:

a. Allow for thermal movement resulting from 120 deg F (49 deg C) change (range) in ambient and 180 deg F (82 deg C) surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
b. Fabricate hot-dip galvanized fabrications so that field assembly will be by bolted connections and not welding.
c. Fabricate joints exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

D. Assembly Requirements:

1. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
2. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
3. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/4 in by 1-1/4 in (6 mm by 31 mm), with a minimum 6 in (150 mm) embedment and 2 in (50 mm) hook, not less than 8 in (200 mm) from ends and corners of units and 24 in (600 mm) on center, unless otherwise indicated.
4. Complete fabrication prior to shop painting or hot-dip galvanizing.

E. Shop-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. Weld corners and seams continuously to develop full strength of member to comply with following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

## 2.10 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural framework as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 in (32 mm) wide by 1/4 in (6 mm) thick by 8 in (200 mm) long at 24 in (600 mm) on center, unless otherwise indicated.

## 2.11 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 in (150 mm) from each end, 6 in (150 mm) from corners, and 24 in (600 mm) on center, unless otherwise indicated.

2.12 FINISHES, GENERAL

A. Finish Quality Standard: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish metal fabrications after assembly.
2. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL FINISHES

A. Unprotected Areas:

1. Galvanized Finish: Hot-dip galvanize according to following. For surfaces to be painted, do not quench or apply post galvanizing treatments that might interfere with paint adhesion. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

a. Steel and Iron Products: ASTM A 123.
b. Steel and Iron Hardware: ASTM A 153.

2. Cleaning: After galvanizing, thoroughly clean surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

B. Protected Areas:

1. Shop Priming: Comply with Division 09 Section "Painting" and as follows:

a. Preparation of Uncoated Surfaces: Prepare uncoated surfaces to comply with requirements of coating product to be used, but not less than minimum requirements of SSPC-SP 6/NACE No. 3 surface preparation specifications and environmental exposure conditions of installed fabrications.
b. Application: SSPC-PA 1; apply shop primer to uncoated surfaces. Stripe paint corners, crevices, bolts, welds, and sharp edges.

C. Field-Applied Coatings: As specified in Division 09 Section "Painting". Paint all steel fabrications unless noted otherwise.

2.14 STAINLESS STEEL FINISHES

A. Stainless Steel Fabrications: As-fabricated finish.

2.15 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive metal fabrications and associated Work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

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

3.3 PREPARATION

A. General: Comply with manufacturer/fabricator's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF METAL FABRICATIONS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, through bolts, lag bolts, and other connectors.

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

C. Connections at Unprotected Areas: 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 units that have been coated or finished after fabrication and are intended for bolted or screwed field connections or other means without further cutting or fitting.

D. Field Welding: Weld connections continuously to develop full strength of member to comply with 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 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.

E. Corrosion Protection: Coat concealed aluminum surfaces that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with heavy coat of bituminous paint.

3.5 INSTALLATION OF MISCELLANEOUS ITEMS

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

3.6 ADJUSTING AND CLEANING

A. Touch-Up Painting: 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. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.

B. Galvanized Surfaces at Unprotected Areas: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 06 1053

MISCELLANEOUS ROUGH CARPENTRY

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Miscellaneous rough carpentry and supplementary items necessary for installation.

### 1.2 DEFINITIONS

A. Dimension Lumber: Lumber of 2 in nominal (38 mm actual) or greater, but less than 5 in nominal (114 mm actual) in least dimension.

B. Lumber Grading Agencies:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.
3. NLGA: National Lumber Grades Authority.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

### 1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Preservative-Treated Wood: 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, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
3. Fire-Retardant-Treated Wood: 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, both before and after exposure to elevated temperatures when tested according to ASTM D 5664.
4. Waterborne-Treated Wood: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Warranties: Include copies from chemical treatment manufacturers for each type of treatment.

### 1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.

B. Miscellaneous Rough Carpentry within Roofing System Assemblies: Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing system assembly and flashings shall be fabricated and installed to withstand specified uplift pressures and thermally induced movement without contributing to failure of roofing system or flashings.

C. Surface Burning Characteristics for Fire-Retardant-Treated Wood: Products and construction identical to assemblies tested for fire resistance according to ASTM E 84/NFPA 255/UL 723 and included under Category BPVV published in Underwriters Laboratories, Inc. (UL) "Fire Resistance Directory"; or listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Flame Spread: Class A - no greater than 25.
2. Smoke Developed: No greater than 450.

2.3 WOOD PRODUCTS

A. Dimension Lumber:

1. Material Quality Standards: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with applicable rules of any rules-writing agency certified by ALSC Board of Review. Provide lumber graded by an agency certified by ALSC Board of Review to inspect and grade lumber under rules indicated.
2. Grade: Provide No. 2 grade, of any of following species:

   a. Hem-fir (north); NLGA.
   b. Hem-fir; WCLIB, or WWPA.

c. Mixed southern pine; SPIB.
d. Spruce-pine-fir; NLGA.
e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
f. Douglas fir-larch; WCLIB or WWPA.
g. Douglas fir-larch (north); NLGA.
h. Douglas fir-south; WWPA.
i. Northern species; NLGA.
j. Eastern softwoods; NeLMA.
k. Western woods; WCLIB or WWPA.

3. Grade Marking: Factory mark each piece of lumber with grade stamp of grading agency.
4. Sizes: Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
5. Finish: Provide dressed lumber, sanded four sides, unless otherwise indicated.
6. Maximum Moisture Content:

a. Provide kiln-dry lumber with 19 percent maximum moisture content at time of dressing for 2 in nominal (38 mm actual) thickness or less, for concealed conditions.
b. Provide kiln-dry lumber with 15 percent maximum moisture content at time of dressing for 2 in nominal (38 mm actual) thickness or less, for exposed conditions.

B. Plywood:

1. Material Quality Standard: DOC PS 1, Exposure 1.
2. Grades: Furnish the grades below according to installation location:

a. A-C; when exposed at occupied interior locations.
b. B-C; when exposed at mechanical and electrical equipment rooms.

3. Grade Marking: Factory mark each piece of plywood with grade stamp of grading agency.
4. Thickness: Not less than 1/2 in (12 mm), unless indicated otherwise.

2.4 TREATED WOOD PRODUCTS

A. Preservative-Treated Wood:

1. Product Quality Standard: AWPA, Use Category UC4a, for species, product, preservative, and end use. Use preservative treatment that does not promote corrosion of metal fasteners.
2. Description: Wood products impregnated with chemicals by pressure process acceptable to authorities having jurisdiction, according to the following:

a. Listed in Section 4 of AWPA U1.
b. Containing no arsenic or chromium.

3. Field Preservative-Treatment for Cut Surfaces: Apply one of the following depending upon conditions listed below, in accordance with AWPA M4:

a. Continuously Protected from Liquid Water: Inorganic boron.

b. Not Continuously Protected from Liquid Water: Copper naphthenate.

B. Fire-Retardant-Treated Wood:

1. Product Quality Standards: Provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction. Use fire-retardant treatment that does not promote corrosion of metal fasteners.

a. Concealed Wood Blocking: Chemical formulations for fire retardant treatment to contain a compatible, non-bleed, light fast, colored dye to identify and indicate treatment.

2. Description: Wood products impregnated with chemicals by pressure process, or other means acceptable to authorities having jurisdiction, having following characteristics:

a. Fire-retardant-treated materials shall comply with performance requirements specified above after being subjected to accelerated weathering according to ASTM D 2898.
b. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood.
c. Use Interior Type A High Temperature (HT), unless otherwise indicated.

C. Moisture Content: Kiln-dry wood after treatment to following maximum moisture content:

1. 19 percent for lumber.
2. 15 percent for plywood.

D. Quality Marking: Identify with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

2.5 FASTENERS

A. Fastener Types and Materials: Select fasteners for type, grade, and class required. Unless otherwise indicated, furnish Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 / F 1941M, Class Fe/Zn 5, within roofing system assemblies.

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

C. Power-Driven Fasteners: ICC-ES NER-272.

D. Powder-Actuated Fasteners: ANSI A10.3; low velocity, powder-actuated fasteners; drive pins and washers fabricated from corrosion-resistant materials; powder loads suitable for application indicated; and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

E. Wood Screws: ASME B18.6.1, flat head, carbon steel.

F. Screws for Fastening to Metal Framing: As specified in the following locations:

1. Division 05 Section "Cold-Formed Steel Framing".
2. Division 09 Section "Gypsum Board Assemblies".

G. Lag Bolts: ASME B18.2.1/ASME B18.2.3.8M.

H. Bolts: Steel bolts complying with ASTM A 307, Grade A / ASTM F 568M, Property Class 4.6; with ASTM A 563 / ASTM A 563M hex nuts and, where indicated, flat washers.

2.6 ANCHORS

A. Anchors: Capable of sustaining, without failure, a load equal to 6 times load imposed when installed in unit masonry and 4 times load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

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

C. Post-Installed Anchors:

1. Generic Type: Torque-controlled expansion anchors.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 / F 1941M, Class Fe/Zn 5, unless otherwise indicated.
3. Material for Exterior Locations and where Stainless Steel is indicated: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products, fabrications, and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

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

C. General Requirements:

1. Securely attach Work to substrate according to authorities having jurisdiction.
2. Select fasteners of appropriate size, type, and length that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Predrill members when necessary to avoid splitting wood while installing fasteners. Do not countersink nail heads, unless otherwise indicated. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
3. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber.
4. Do not use material with the following conditions:

    a. Material that is warped or does not comply with requirements for untreated material.
    b. Materials with defects that interfere with function of member.
    c. Pieces which are too small to use with minimum number of joints or optimum joint arrangement.

5. Set carpentry to required levels and lines, with members plumb, true to line, and level. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
6. Apply field preservative-treatment to cut surfaces of preservative-treated wood.
7. Where preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Schedule of Applications:

1. Preservative-Treated Wood: Use preservative-treated wood for the following applications:

    a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing systems.
    b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
    c. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

2. Fire-Retardant-Treated Wood: Use fire-retardant-treated wood for the following applications:

    a. Concealed wood blocking within interior partitions.
    b. Exposed plywood backing panels supporting equipment at interior locations.

3. Untreated Wood: Not allowed.

3.3 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Coordinate locations with other work involved.

B. Securely attach items to substrates to support applied loading.

3.4 PLYWOOD INSTALLATION

A. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

B. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

3.5 PROTECTION

A. General: Protect untreated wood, and wood that has been treated with chemicals that can leach, from deterioration due to weather.

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EL PASO, TEXAS

SECTION 06 4023

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Shop-finished interior architectural woodwork and supplementary items necessary for installation.

B. Related Section: Refer to Division 06 section "Translucent Resin Panel Fabrications" for decorative acrylic panels.

1.2 DEFINITIONS

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

B. Exposed Surfaces, Semi-Exposed Surfaces, Concealed Surfaces, Types of Cabinet Construction, and other related terms are defined in referenced quality standards.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Wood Veneered Items: Include finishing materials and processes.
3. Fire Retardant Treated Wood: Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
4. Wood Paneling with Transparent Finish: For paneling noted or schedule to be blueprint matched work, show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples for Verification:

1. Items with Plastic Laminate Finish:

a. Plastic laminates, 8 in by 10 in (200 mm by 250 mm), for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Certification: Certified participant in AWI's Quality Certification Program or licensee of WI's Certified Compliance Program.

B. Quality Standard: Unless otherwise indicated, comply with "Architecural Woodwork Standards" for standards and for grades of interior architectural woodwork indicated for construction, finish, installation and other requirements:

1. Provide manufacturer certification indicating that woodwork complies with requirements of referenced quality standards.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.

C. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated or required, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

D. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Provide materials that comply with requirements of "Architectural Woodwork Standards" quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

2.3 MATERIALS

A. Fire Retardant Wood Products for Paneling:

1. Medium-Density Fiberboard: ANSI A208.2, minimum Grade 130-MR50, made with binder containing no added urea formaldehyde.
2. Particleboard: ANSI A208.1, Industrial Grade M-2 Exterior Glue, made with binder containing no added urea formaldehyde, 43 pcf (753kgm3) Density.

B. Wood Products for Cabinets:

1. Hardboard for Vertical Dividers Only: AHA A135.4, tempered, smooth two sides, 1/4 in (6 mm) minimum thickness unless indicated otherwise.
2. Medium-Density Fiberboard: ANSI A208.2, minimum Grade 130-MR50, made with binder containing no added urea formaldehyde.
3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no added urea formaldehyde.
4. Softwood Plywood: DOC PS 1.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Fire-Rated Laminates: Where indicated or scheduled; NEMA LD 3, grades as follows:

a. Vertical Surfaces: General Purpose Type 604 (VGF), 0.032 in (0.79 mm) thick.
b. Horizontal Surfaces: General Purpose Type 605 (HGF) 0.048 in (1.2 mm) thick.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated or required, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.

1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or 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 UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment types:

1. Interior Type A: Low-hygroscopic formulation.
2. Mill lumber before treatment and implement special 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.
3. Kiln-dry materials before and after treatment to levels required for untreated materials.

C. Fire-Retardant Particleboard: Panels complying with the following requirements, 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 per ASTM E 84.

D. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, 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 200 or less per ASTM E 84.

2.5 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

1. Refer to Interior Design Documents for additional hardware selections.

B. Hinges: Provide number of hinges recommended by hinge manufacturer for size and weight of door.

C. Butt Hinges: 2-3/4 in (69 mm), 5-knuckle steel hinges made from 0.095 in (2.4 mm) thick metal, and as follows:

1. Semi-concealed Hinges for Flush Doors: BHMA A156.9, B01361.
2. Semi-concealed Hinges for Overlay Doors: BHMA A156.9, B01521.

D. Frameless Concealed Hinges (European Type Soft-Closing): BHMA A156.9, B01602,

1. Product Standard: Grass; "Tiomos 120 Series", 120 degree swing, self-closing from 10 deg.

a. Angle Reduction Clip: Provide angle reducing clip at doors adjacent to walls and corners, door swing to be limited to 85 degrees. Finish: Steel with nickel plating. Manufacturer and Product: Grass; Tiomos Angle Reduction Clip, F072135751.

E. Self-Closing Hinges: At PPE cabinets.

F. Continuous Hinges: At bench.

G. Touch Latch: At PPS cabinets with positive latching.

H. Gas Charged Lift Struts: At bench.

I. Back-Mounted Pulls: BHMA A156.9, B02011.

J. Wire Pulls: Back mounted, solid metal, 4 in (100 mm) long, 5/16 in (8 mm) in diameter.

1. Product Standard: EPCO-MC-402-4, 4 in (100 mm) center to center of screws, 1-5/16 in (34 mm) projection, 5/16 in (8 mm) diameter. Stainless steel.

K. Catches: Magnetic catches, BHMA A156.9, B03141.

L. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

M. Shelf Rests: BHMA A156.9, B04013; metal.

1. Product Standard: K & V No. 345, nickel plated.

N. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 in (150 mm) high and 24 in (600 mm) wide.

   a. Product Standard for 24 in (600 mm) Wide and Less: Full extension; Accuride "7434".
   b. Product Standard for Wider than 24 in (600 mm): Full extension; Accuride "7432".

3. Trash Bin Slides: Grade 1HD-200; for trash bins not more than 20 in (500 mm) high and 16 in (400 mm) wide.

O. Door Locks: BHMA A156.11, E07121.

1. Product Standard: K & V No. 984, nickel plated.

P. Drawer Locks: BHMA A156.11, E07041.

1. Product Standard: K & V No. 986, nickel plated.

Q. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Size: 1-1/4 in (32-mm) or 2 in (50 mm) OD as indicated.
2. Color: To match counter top.
3. Product Standards: Doug Mockett & Company, Inc "OG or SG Series" or Hafele 429.93.

R. Wood Louvers:

1. Cutout Size: 9-15/16 in (228-mm).
2. Wood Species: Maple (83).
3. Product Standards: Doug Mockett & Company, Inc "LWAVG/S10-9-15/16" square wood air vent grill.

S. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630, unless otherwise indicated.

T. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

U. Manufacturers:

1. Accuride.
2. Julius Blum, Inc.
3. The Engineered Products Company.
4. Grass America, Inc.
5. Hafele America Company.
6. Hettich America Corporation.
7. Knape & Vogt Manufacturing Company (K & V).
8. Stanley Hardware, Division of the Stanley Works.

V. Cabinet Accessories:

1. Counter Support Brackets: Unless noted otherwise, provide brackets factory-primed for field painting.

   a. Manufacturers and Products:

      1) A&M Hardware, Inc.; Work Station Brackets.
      2) Rakks/Rangine Corporation; Counter Support Brackets, EH Series.

W. Tackable Wall Surface:

1. Fabric Wall Coverings: Provide wall coverings with following surface burning characteristics as determined by testing identical products per ASTM E 84/NFPA 255/UL 723. Identify wall coverings with appropriate markings of applicable testing and inspecting organization.

   a. Flame Spread: 25 or less; Smoke Developed: 450 or less.
   b. Selections: As scheduled or as indicated in Design Selections.

2. Substrate Material: Fiberglass board, ASTM C 612, Class 1 and 2; 6 pcf (96 kgm3) density, compressible, unfaced, with chemically hardened edges.
3. Panel Fabrication: Fabricate panels to sizes and configurations indicated; attach facing materials to core (substrate material) to produce installed panels with visible surfaces fully covered and free from waves in fabric weave, wrinkles, sags, blisters, seams, adhesive, or other foreign matter.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives:

1. General: As recommended by woodwork fabricator to suit application.

D. Hanging Clips: Provide manufacturer's standard nonferrous-metal or hot-dip galvanized zee hanging clips.

2.7 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium Grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fire Retardant Treated Wood: Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 in (19 mm) Thick or Less: 1/16 in (1.5 mm).
2. Edges of Rails and Similar Members More Than 3/4 in (19 mm) Thick: 1/8 in (3 mm).

E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.8 FLUSH PLASTIC-LAMINATE PANELING

A. Grade: Premium.

B. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Faces: Grade HGS, 1.0 mm thick.
2. Edges: Same as faces.

C. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKH, 1.0 mm thick.

D. Fire-Retardant-Treated Paneling: Provide panels consisting of fire-retardant plastic laminate and fire-retardant particleboard or fire-retardant medium-density fiberboard. Panels shall have a flame-spread rating of 75 or less and a smoke-developed rating of 450 or less per ASTM E 84.

2.9 PLASTIC-LAMINATE CABINETS

A. Grade: Premium.

B. AWI Type of Cabinet Construction: Flush overlay unless indicated otherwise.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGP, .038 in (1 mm) thick.
2. Postformed Surfaces: Grade HGP, .038 in (1 mm) thick.
3. Doors and Vertical Surfaces: Grade VGS, .028 in (0.7 mm) thick.
4. Edges: PVC Edge Banding, 0.12 in (3 mm) thick, matching laminate in color, pattern, and finish.

D. Semi-exposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade CLS, .020 in (0.5 mm) thick.
2. Edges: PVC Edge Banding, .038 in (1 mm) thick, matching laminate in color, pattern, and finish.
3. Drawer Sides, Backs and Sub-Fronts: 1/2 in (12 mm) minimum thickness, as indicated.

   a. Solid-hardwood lumber.

4. Drawer Bottoms: 1/4 in (6 mm) minimum thickness, as indicated.

   a. Hardwood plywood with veneer core.

5. Drawer Box Construction: One of the following:

   a. Glued multiple dovetail.
   b. Glued French dovetail.
   c. Glued and doweled.

6. Interior Drawer Box Finish, as indicated:

   a. Clear catalyzed polyurethane.

E. Body Members (Ends, Divisions, Bottoms and Sub-Tops): Medium-density fiberboard, 3/4 in (19 mm) minimum thickness.

F. Face Frames, Rails, Kicks and Bases: Solid-hardwood lumber or hardwood plywood, 3/4 in (19 mm) thick minimum thickness.

G. Shelves: Hardwood plywood with veneer core with the following thickness:

1. For Spans Up To 32 in (800 mm): 3/4 in (19 mm).
2. For Spans Up To 42 in (1050 mm): 1 in (25 mm).

H. Drawer Fronts: Medium density fiberboard, 3/4 in (19 mm) thick minimum thickness.

I. Doors:

1. Hinged Flush Type: Medium density fiberboard with minimum thickness of 3/4 in (19 mm).

a. Maximum cabinet door size: 20 in (500 mm) width and 84 in (2100 mm) height.
b. For Doors Larger than Sizes Above: 1-3/8 in (35 mm) or 1-3/4 in (45 mm) doors; refer to Division 08 Section "Flush Wood Doors".
c. If hinge screws enter only edge of door, provide 3/4 in (19 mm) lumber edges glued to core prior to laminating.

J. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL, .020 in (0.5 mm) thick.

K. Concealed Edges of Base Cabinet Panels: Including but not limited to floors, vertical edges, splashes and countertops; Clear Catalyzed Polyurethane.

2.10 SOLID SURFACING COUNTERTOPS

A. Refer to Division 12 Section "Simulated Stone Countertops".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive interior architectural woodwork and associated work to which interior architectural woodwork will be applied for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Quality standards. (The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.)
2. Respective manufacturer/fabricator's written installation instructions.
3. Accepted submittals.
4. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

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

3.4 INSTALLATION

A. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication, to extent that it was not completed in the shop.

B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 in per 96 in (3 mm per 2400 mm).

C. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

D. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening, unless covered by trim or otherwise indicated.

1. Install flush paneling with no more than 1/16 in per 96 in (1.5 mm per 2400 mm) vertical cup or bow and 1/8 in per 96 in (3 mm per 2400 mm) horizontal variation from a true plane.
2. Flush Paneling with Revealed Joints: Install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 in (0.75 mm).

G. Cabinets, General: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 in per 96 in (3 mm per 2400 mm) sag, bow, or other variation from a straight line.

H. Base and Wall Cabinets: Set base cabinets straight, level, and plumb. Adjust subtops within 1/16 in (1.5 mm) of a single plane. Fasten base cabinets to partition framing, or reinforcements in partitions with fasteners spaced 24 in (600 mm) on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.

1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24 in (600 mm) on center. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.
2. Wall Cabinets: Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 in (400 mm) on center with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish or toggle bolts through metal backing or metal framing behind wall finish.

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.5 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

UMC EL PASO CHILDREN'S HOSPITAL
8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 06 6413

TRANSLUCENT RESIN PANEL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes translucent resin panel (aka "3Form") fabrications and supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: 8 by 10 in (200 by 250 mm), for each type, color, pattern, and surface finish of translucent resin panel products.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 3 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 3 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

C. Fire-Test-Response Characteristics: Provide panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

D. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.4 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.5 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. 3Form, Inc.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 FABRICATION

A. Comply with manufacturer's written recommendations for fabrication.

B. Machining: Acceptable means of machining are listed below. Ensure that material is not chipped or warped by machining operations.

1. Sawing: Select equipment and blades suitable for type of cut required.
2. Drilling: Drills specifically designed for use with plastic products.
3. Milling: Climb cut where possible.
4. Routing.
5. Tapping.

C. Forming: Form products to shapes indicated using the appropriate method listed below. Comply with manufacturer's written instructions.

1. Cold Bending.
2. Hot Bending.
3. Thermoforming: Acceptable only on uncoated material.
4. Drape Forming.
5. Matched Mold Forming.
6. Mechanical Forming.

D. Laminating: Laminate to substrates indicated using adhesives and techniques recommended by manufacturer.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide products of material, size, and shape required for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaner: Type recommended by manufacturer.

C. Fasteners: Use screws designed specifically for plastics. Self-threading screws are acceptable for permanent installations. Provide threaded metal inserts for applications requiring frequent disassembly such as light fixtures.

D. Bonding Cements: Manufacturer's recommended bonding adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Approved submittals.
3. Contract Documents.

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

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Manufacturer's shop to fabricate items to the greatest degree possible.

B. Utilize fasteners, adhesives and bonding agents recommended by manufacturer for type of installation indicated. Material that is chipped, warped, hazed or discolored as a result of installation or fabrication methods will be rejected.

C. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

D. Form field joints using manufacturer's recommended procedures. Locate seams in panels so that they are not directly in line with seams in substrates.

3.5 CLEANING AND PROTECTION

A. Protect surfaces from damage until date of substantial completion. Repair work or replace damaged work, which cannot be repaired to Architect's satisfaction.

3.6 TRANSLUCENT RESIN PANEL SCHEDULE

END OF SECTION

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 07 0152

PATCHING OF EXISTING ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Work required of this Section includes cutting and patching of existing roofing for new mechanical equipment; and supplementary items necessary to complete the installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Submit documentation as specified in Warranties article of this specification section.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

a. Installer is to be approved by warrantor of existing roofing system to work on existing roofing.

C. Quality Standards:

1. Unless otherwise recommended by roofing manufacturer provide built-up roofing system in accordance with recommendations of the NRCA "Roofing and Waterproofing Manual" for roofing type indicated.

2. Comply with FM System Loss Prevention Data Standard 1-49 for attachment and anchorage if nailers, blocking, cants, and other associated members.
3. Comply with FM System Loss Prevention Data Standards 1-28 and 1-28S for attachment and anchorage of roof insulation to metal decking.

1.5 PREINSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions will permit roofing to be installed in accordance with manufacturers' recommendations and warranty requirements.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during Work, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.

1. Notify warrantor of existing roofing system on completion of Work, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. New materials required by the Work shall be compatible with the existing products.

2.2 PERFORMANCE REQUIREMENTS

A. General: Cut existing membrane roofing and replace with new membrane roofing to ensure a watertight, roofing and base flashing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. Water Drainage: New work shall maintain existing water drainage patterns; if new work adversely affects the water drainage, make necessary roofing changes to accommodate new water drainage pattern.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations of standards specified in Quality Assurance article of this specification section.

B. Protect other work from damage during application of roofing materials. Replace/restore other work damaged when installing roofing system work.

C. Coordinate installing roofing system components so insulation and roofing plies are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.

END OF SECTION

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EL PASO, TEXAS

SECTION 07 8413

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes penetration firestopping systems for openings and penetrations through smoke and fire-resistance-rated assemblies, and supplementary items necessary to complete their installation.

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

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

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.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.4 CLOSEOUT SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

B. Environmental Limitations: Do not install firestopping systems when ambient or substrate temperatures are outside limits permitted by firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

C. 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 installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate firestopping systems.

D. Notify Owner's inspecting agency at least seven days in advance of firestopping system installations; confirm dates and times on days preceding each series of installations.

E. Do not cover up firestopping system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. Acceptable Manufacturers: Manufacturer is "acceptable" if firestopping system has been tested and listed by UL or other testing and inspection agency acceptable to authorities having jurisdiction and manufacturer can evidence product compliance with requirements of the Contract Documents.

1. FM Global: Manufacturer to provide firestopping products in compliance with FM Global requirements as indicated in "Quality Assurance" Article.

B. Compatibility: Provide firestopping systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestopping systems, under conditions of service and application, as demonstrated by firestopping system manufacturer based on testing and field experience.

C. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials and approved by the qualified testing and inspection agency for firestopping systems indicated.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

B. 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. Provide rated systems complying with the following requirements:

a. Penetration firestopping systems shall bear classification marking of a qualified testing agency acceptable to authorities having jurisdiction.

1) UL Fire Resistance Directory.
2) Intertek Group Directory of Listed Building Products.
3) FM Global Building Materials Approval Guide.

2.3 PENETRATION FIRESTOP 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. Classified in Underwriters Laboratories (UL) Fire Resistance Directory, Section XHEZ - Penetration Firestop System", and/or Section XHHW - Fill Void or Cavity Materials for specific project conditions.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479.

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.

a. Penetrations located outside wall cavities.
b. Penetrations located outside fire-resistive shaft enclosures.
c. Penetrations located in construction containing fire-protection-rated openings.

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.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.

E. Penetrations in Fire-Resistance-Rated Smoke Barriers: In addition to penetration firestopping systems with L-Ratings determined per UL 1479, provide F-Ratings and T-Ratings determined per ASTM E 814 or UL 1479.

F. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

G. 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.

2.4 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.

K. Additional Application Requirements:

1. Firestops exposed to view and/or are scheduled to receive finishes shall be paintable or capable of receiving finish materials.
2. Firestops exposed to traffic, moisture, and physical damage shall be products that do not deteriorate when exposed to these conditions.
3. Firestops for water piping penetrations, of any type, shall be moisture-resistant products.
4. Firestops for floor penetrations with annular spaces exceeding 4 in (100 mm) or more in width and exposed to possible loading and traffic shall be products capable of supporting the floor loads involved either by installing floor plates or by other means.
5. Firestops for penetrations involving insulated piping shall be products that do not require removal of insulation.
6. Firestops for cable trays and future penetrations shall be reusable pillows or bags.

L. Provide firestops within fire resistive walls and partitions containing flush mounted devices such as outlet boxes, electrical cabinets and mechanical cabinets mounted back to back and spaced less than 24 inches on center in accordance with UL Fire Resistance Directory "Wall Opening Protective Materials", Category CLIV.

## 2.5 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. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Surface Cleaning: Before installing fire-resistive penetration systems, clean penetrations immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements.

1. Remove foreign materials from surfaces of openings, joints and penetrating items that could interfere with adhesion of firestopping.
2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form release agents from concrete.

C. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

D. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

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

3.4 INSTALLATION OF PENETRATION FIRESTOPS

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 for penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 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 (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

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 (150 mm) 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. Tested System or Engineered Judgement Number.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.

C. 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.

1. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractors expense.

D. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.7 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping system products and of products in which opening and joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 07 8446

FIRE RESISTIVE JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes firestopping systems for joints at perimeter and through smoke and fire-resistance-rated assemblies, and supplementary items necessary to complete their installation.

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

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.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

1.4 CLOSEOUT SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Compatibility and Adhesion Testing: Manufacturer of fire stopping material shall be responsible for testing samples of materials that will contact or affect firestopping materials.

1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of fill materials to joint substrates.
2. Perform tests under environmental conditions replicating those that will exist during installation.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain fire-resistant joint sealants manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

B. Environmental Limitations: Do not install firestopping systems when ambient or substrate temperatures are outside limits permitted by firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

C. 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 installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

C. Coordinate sizing of joints to accommodate joint firestopping systems.

D. Notify Owner's inspecting agency at least seven days in advance of firestopping system installations; confirm dates and times on days preceding each series of installations.

E. Do not cover up firestopping system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. Acceptable Manufacturers: Manufacturer is "acceptable" if firestopping system has been tested and listed by UL or other testing and inspection agency acceptable to authorities having

jurisdiction and manufacturer can evidence product compliance with requirements of the Contract Documents.

1. FM Global: Manufacturer to provide firestopping products in compliance with FM Global requirements as indicated in "Quality Assurance" Article.

B. Compatibility: Provide firestopping systems that are compatible with one another and the substrates forming openings, under conditions of service and application, as demonstrated by firestopping system manufacturer based on testing and field experience.

C. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials. Use only components specified by firestopping system manufacturer and approved by the qualified testing and inspecting agency for firestopping systems indicated.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gasses.

B. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory.
2) Intertek Group in its Directory of Listed Building Products.
3) FM Global in its "Building Materials Approval Guide.

2.3 JOINT FIRESTOPPING SYSTEMS.

A. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.

1. F-Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

B. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).

1. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.

C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than

25 and 450, respectively, as determined per ASTM E 84.

D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

E. Joints, required for control of movement, at intersection between Rated Wall Assemblies and Nonrated Horizontal Assemblies: Provide joint firestopping with ratings determined by ASTM E 2837.

2.4 TOP-OF-WALL JOINT FIRESTOPPING

A. Safing Insulation: Semi rigid board insulation produced by combining slag-wool fibers with thermosetting resin binders and complying with the following:

1. ASTM C 612, Type 1A and 1B.
2. Nominal density of 4 lb/cu. ft.
3. ASTM E119 Fire rating indicated, but not less than 2 hours.

B. Coating Material: Manufacturers standard fill material or spray applied product for sealing surface of safing insulation and adjacent construction against penetration of fire and smoke.

C. Fire Resistive Sealants: Intumescent single-component, water based, high solids, elastomeric sealants. Nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions

3.2 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove foreign materials from surfaces of joints that could interfere with adhesion of firestopping.

2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form release agents from concrete.

C. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

D. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLATION - GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

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

3.4 INSTALLATION OF FIRE-RESISTANT JOINT SEALANTS

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 INSTALLATION OF FIRE SAFING PROTECTION

A. Top of Wall: Install safing insulation to fill gap between top of wall and floor slab above. Cut safing insulation 50 percent wider than gap to be filled to ensure compression fit.

3.6 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. 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 - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Tested System or Engineered Judgment Number.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

C. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

1. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractors expense.

D. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

E. Where required, inspection of fire resistive joint firestopping shall be performed in accordance with ASTM E 2393, "Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers" or other recognized standard.

3.8 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping system products and of products in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

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EL PASO, TEXAS

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Joint sealants, backing materials, and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Samples for Verification Purposes: Samples for each kind and color of joint sealants in 1/2 in (12 mm) wide joints formed between two 6 in (150 mm) long strips of material matching 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, primers and backers.
4. Joint-sealant color.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

B. Pre-Construction Compatibility and Adhesion Testing: Provide samples of joint substrate materials that will contact or affect urethane and silicone joint sealants to respective joint sealant manufacturers for following testing:

1. General Requirements: Test materials forming joint substrates and joint sealant backings for compatibility and adhesion with joint sealants.
2. Test Method: Manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

3. Specimen Quantity: Provide not fewer than number of pieces required of each kind of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
4. Reports: Interpret test results and certify reports indicating requirements for primers and substrate preparation needed for adhesion or for corrective measures including use of specially formulated primers.
5. Equivalent Option to Testing: Testing may not be required if joint sealant manufacturer's joint preparation data is based on previous testing, not older than 12 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

C. Pre-Construction Stain Testing: Submit samples of joint substrate materials that will contact or affect urethane and silicone joint sealants to respective joint sealant manufacturers for following testing:

1. General Requirements: Test materials forming joint substrates for resistance to staining caused by joint sealants.
2. Test Method: ASTM C 1248.
3. Specimen Quantity: Provide not fewer than number of pieces required by testing laboratory of each kind of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
4. Reports: Interpret test results and certify reports indicating if joint sealants stain substrate materials.
5. Equivalent Option to Testing: Testing may not be required if joint sealant manufacturer's joint preparation data is based on previous testing, not older than 12 month, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.4 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Ambient Conditions: Install joint sealants within range of ambient and substrate temperatures and moisture conditions as recommended by manufacturer. Protect substrates from environmental conditions that affect performance.

1. Do not apply to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

B. Weather Conditions Limitation: Proceed with Work only when existing and forecasted weather conditions will permit installation according to manufacturer's instructions and warranty requirements.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.7 WARRANTY

A. Manufacturer's Warranty for Silicone Sealants: Furnish manufacturer's written material for a period of 20 years from date of Substantial Completion signed by an authorized representative using manufacturer's standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

B. Installer's Warranty: Furnish installer's written warranty for a period of 2 years from date of Substantial Completion signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Compatibility: Joint sealants, backings, and other related materials shall be 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.

C. Suitability for Contact with Food: Comply with authorities having jurisdiction for joints in repeated contact with food.

D. Sealant Color: As scheduled or as indicated in Design Selections.

2.3 EXTERIOR ELASTOMERIC SEALANTS

A. Exterior Non-sag Silicone Sealant:

1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 50 or 100/50.
2. Description: Single component, non-sag, neutral cure, non-staining as determined by pre-construction stain testing, and non-bleeding, silicone sealant.
3. Joint Movement Capability:

   a. Class 50: Plus 50 percent, minus 50 percent.
   b. Class 100/50: Plus 100 percent, minus 50 percent.

4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:

a. Class 50:

1) Dow Corning; 795 Silicone Building Sealant.
2) Momentive Performance Materials, GE Silicones; Silpruf SCS2000.
3) Pecora Corp.; 864NST.
4) Sika Corp., Construction Products Div.; Sikasil WS-295.
5) Tremco Commercial Sealants & Waterproofing; Spectrem 3.

b. Class 100/50:

1) Dow Corning; 790 Silicone Building Sealant.
2) Momentive Performance Materials, GE Silicones; Silpruf LM SCS2700.
3) Pecora Corp.; 890NST.
4) Sika Corp., Construction Products Div.; Sikasil WS-290.
5) Tremco Commercial Sealants & Waterproofing; Spectrem 1.

2.4 INTERIOR ELASTOMERIC SEALANTS

A. Interior Non-sag Silicone Sealant:

1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25.
2. Description: Single component, non-sag, moisture curing, silicone sealant specially formulated with fungicide for use in sanitary non-porous applications.
3. Manufacturers and Products:

a. Dow Corning; 786 Silicone Sealant.
b. Momentive Performance Materials, GE Silicones; Sanitary SCS1700.
c. Pecora Corp.; 898.
d. Sika Corp., Construction Products Div.; Sikasil GP
e. Tremco Commercial Sealants & Waterproofing; Tremsil 200.

B. Interior Non-sag Urethane Sealant:

1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25 or 35.
2. Description: Single component, non-sag, moisture curing, non-staining as determined by pre-construction stain testing if exposed, polyurethane sealant.
3. Joint Movement Capability: Plus 25 percent, minus 25 percent, or plus 35 percent, minus 35 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:

a. BASF; MasterSeal NP 1 (Formerly Sonolastic NP 1).
b. Pecora Corp.; Dynatrol I-XL.
c. Sika Corp., Construction Products Div.; Sikaflex 1a or Sikaflex Textured Sealant.
d. Tremco Commercial Sealants & Waterproofing; Dymonic or Vulkem 116.

C. Interior Non-sag Acrylic Latex Sealant:

1. Product Quality Standard: ASTM C 834, Type and Grade as required by conditions.
2. Description: Single component, non-sag, moisture curing, general purpose, paintable, siliconized acrylic latex sealant.
3. Joint Movement Capability: Plus 7.5 percent, minus 7.5 percent

4. Manufacturers and Products:

   a. Pecora Corp.; AC 20+.
   b. Tremco Commercial Sealants & Waterproofing; Tremflex 834.

D. Sprayed Foam Insulating Gap Filler:

1. Description: Low pressure, one-component, expanding, open-cell latex-based insulating foam gap filler; applied with professional hand-held dispensing gun; CFC and HCFC free.
2. Performance Requirements: Class 1 Fire-Retardant per ASTM E 84.
3. Manufacturers and Products:

   a. Convenience Products; Touch 'ÜN Foam, Easy Fill Latex Foam Sealant.
   b. DAP Products, Inc.; DAPtex Plus.

E. Acoustical Sealants: As specified in Division 09 Section "Gypsum Board Assemblies".

F. Fire Resistive Sealants: As specified in Division 07 Section "Fire Resistive Joint Firestopping".

2.5 JOINT SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Use open cell (Type O) sealant backing rod at interior line of sealant for double sealed condition unless otherwise recommended by sealant manufacturer.

B. Cylindrical Sealant Backings:

1. Product Quality Standard: ASTM C 1330, Type C, Type O, Type B; as approved in writing by joint-sealant manufacturer for joint application indicated.
2. Description: Extruded polyethylene, polyurethane, or polyolefin in either closed cell structure (Type C), open cell structure (Type O), or bicellular structure with surface skin (Type B) as defined by ASTM Terminology C 717.
3. Size: Diameter approximately 25 percent larger than joint width, unless otherwise directed by manufacturer.
4. Manufacturers and Products:

   a. Type C:

      1) BASF; MasterSeal 920 (Formerly Sonneborn, Closed-Cell Backer Rod).
      2) Nomaco Inc.; Green Rod or HBR.

   b. Type O:

      1) Backer Rod Mfg. Inc.; Denver Foam.
      2) Nomaco Inc.; Foam-Pak II.

   c. Type B:

      1) BASF; MasterSeal 921 (Formely Sonneborn, Soft Backer Rod).

2) Nomaco Inc.; Dual-Rod or Sof-Rod.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials, or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 ACCESSORIES

A. Cleaners for Non-porous 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 non-porous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

B. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrate surfaces to receive products and systems and associated Work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Cleaning of Joints: Clean out joints immediately before installing joint backings and sealants to comply with joint sealant manufacturer's written instructions and following requirements:

1. Remove foreign material that could interfere with adhesion of joint sealant, including, but not limited to, 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.
3. Remove laitance and form-release agents from concrete.
4. Clean non-porous 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.
5. Substrate material allowed by sealant's ASTM C 920 Use Classification.

C. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer, or as indicated by prior experience, or as required by pre-construction compatibility and adhesion testing. 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.

D. 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.

3.4 INSTALLATION

A. Joint Sealant Backings: Install type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear backings.
3. Remove absorbent sealant backings that have become wet or damaged before sealant application and replace with dry materials.
4. Install bond-breaker tape behind sealants where backings are not used between sealants and backs of joints.

B. Joint Sealants: Install at same time as backings using proven techniques that comply with following:

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.
4. 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.

   a. Remove excess sealant from surfaces adjacent to joints.
   b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   c. Use masking tape to protect surfaces adjacent to recessed tooled joints.

5. Install joint sealants in accordance with ASTM C 1193 as applicable to materials, applications, conditions indicated, and with the following profile configurations:

a. Fillet: Figure 5.
b. Bridge: Figure 6.
c. Butt: Figure 8A (concave tooling), generally hour-glass shape with 2:1 width-to-depth ratio.

C. Sprayed Foam Insulating Gap Filler: Apply sprayed foam insulating gap filler within exterior wall assemblies using professional hand-held dispensing gun in accordance with manufacturer's written instructions.

1. Prior to installation of wall finish systems, apply sprayed foam insulating gap filler to gaps, cracks, cavities, openings, and voids in exterior wall back-up, including annular space around piping, ducts, conduits, wiring, and electrical outlets to seal off potential air drafts.
2. After sprayed foam sealant is applied, make flush with face of adjacent wall by using method recommended by manufacturer.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Field Adhesion Testing: Before installation, field test urethane and silicone sealant adhesion to joint substrates as follows:

1. General Requirements:

a. Locate test joints where indicated or, if not indicated, as directed by Architect.
b. Conduct field tests for each kind of urethane and silicone sealants and joint substrates indicated.
c. Notify Architect 7 days in advance of dates and times when test joints will be erected.

2. Test Frequency: Perform 1 test for each 1000 ft (300 m) of joint length thereafter or 1 test for each floor at each elevation.
3. Test Methods: Joint sealant manufacturer's technical representative shall conduct following tests:

a. When Joint Substrates are Identical: Test joint sealants according to ASTM C 1193, Method A (field-applied sealant joint hand pull tab) described below:

1) Conduct one test and one additional test for each 1000 ft (300 m) of kind of joint sealant material and substrate conditions.
2) Install 24 in (600 mm) long test specimens using same materials, methods for joint preparation, and joint sealant installation required for Work. Allow sealants to cure fully before testing.

3) Make horizontal knife cut across width of sealant joint from one substrate to other substrate.
4) Make 2 vertical cuts at both sides of substrates, downward starting at horizontal cut, approximately 3 in (75 mm) long.
5) Grasp 3 in (75 mm) long piece of sealant tab firmly 1 in (25 mm) from its bonded edge and pull at not less than 90 degree angle.
6) Substrate adhesion is acceptable if sealant tears cohesively within itself or elongates to a manufacturer determined extension value from 1 in (25 mm) gauge length before releasing from substrate adhesively.

b. When Joint Substrates are Different: Test joint sealants according to ASTM C 1193, Method C (field-applied sealant joint hand pull flap) described below:

1) Conduct one test and one additional test for each 1000 ft (300 m) of kind of joint sealant material and substrate conditions.
2) Install 24 in (600 mm) long test specimens using same materials, methods for joint preparation, and joint sealant installation required for Work. Allow sealants to cure fully before testing.
3) Make first horizontal knife cut across width of sealant joint from one substrate to other substrate.
4) Make one vertical cut along one side of substrate, downward starting at horizontal cut, approximately 3 in (75 mm) long.
5) Make second horizontal knife cut across width of sealant joint from one substrate to other substrate at opposite end of 3 in (75 mm) long first cut.
6) Grasp 3 in (75 mm) long piece of sealant flap firmly and pull at not less than 90 degree angle.
7) Substrate adhesion is acceptable if sealant tears cohesively within itself or elongates to a manufacturer determined extension value from 1 in (25 mm) gauge length before releasing from substrate adhesively.

4. Reports: Report which sealants and joint preparation methods resulted in optimum adhesion to joint substrates or whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each specimen. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of non-compliance with requirements, will be considered satisfactory. Sealants failing to adhere to joint substrates during testing are not acceptable.

## 3.6 CLEANING

A. In-Progress Cleaning: Remove excess sealant or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.7 PROTECTION

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

3.8 JOINT SEALANT SCHEDULE

1. Exterior Non-sag Silicone Sealant:

   a. Moving joints on exterior side of exterior walls.
   b. Gaps between building materials and components created by items penetrating the primary drainage surface of the exterior building envelope.
   c. Joints between dissimilar materials on exterior side of exterior walls.

B. Interior Elastomeric Sealant Applications:

1. Interior Non-sag Silicone Sealant:

   a. Non-moving joints in moist or damp areas which are susceptible to mildew.
   b. Non-moving joints in toilet rooms.
   c. Non-moving joints in kitchens.
   d. Non-moving joints in repeated contact with food.

2. Interior Non-sag Urethane Sealant:

   a. Building joints on interior side of exterior walls where joint movement is anticipated.

3. Interior Non-sag Acrylic Latex Sealant:

   a. Non-moving joints where another type of sealant is not otherwise specified or scheduled.
   b. Minimal moving joints due to temperature change.

C. Sprayed Foam Insulating Gap Filler Applications:

1. Exterior non-moving gaps around windows, glazed aluminum walls, doors, and penetrations beneath weather-resistant coverings.
2. Interior non-moving gaps around windows, glazed aluminum walls, doors, and penetrations.

END OF SECTION

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EL PASO, TEXAS

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Custom hollow metal doors and frames and supplementary items necessary for installation.

1.2 DEFINITIONS

A. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

B. Exterior: Areas exposed to the elements and areas located in unconditioned spaces.

C. Interior: Areas located in conditioned spaces.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification Purposes: Submit 12 in by 12 in (300 mm by 300 mm) samples to demonstrate compliance with requirements for quality of materials and construction:

1. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
2. Frames: Show profile, head-to-jamb corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.

D. Door and Frame Schedule: Schedule prepared by or under supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Oversize Construction Certification: Documentation for assemblies required to be fire rated and exceeding limitations of labeled assemblies.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4 in (100 mm) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4 in (6 mm) space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Engineer products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

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.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Assemblies complying with UL 1784.

2.3 COMPONENT MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008 / A 1008M, Designation CS (Commercial Steel), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011 / A 1011M, Designation CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Frame Anchors: ASTM A 591 / A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 / A 1008M or ASTM A 1011 / A 1011M, hot-dip galvanized according to ASTM A 153 / A 153M, Class B.

D. Inserts, Bolts, and Fasteners: Device type and size required, hot-dip galvanized according to ASTM A 153 / A 153M, Class B.

E. Fasteners into Concrete:

1. Powder-Actuated Fasteners: Suitable for application indicated, ANSI A 10.3; low velocity, powder-actuated fasteners; drive pins and clip angles fabricated from corrosion-resistant materials, with clips or other devices for attaching frames into concrete substrate.
2. Available Manufacturers:

a. Construction Materials, Inc.
b. Heckman Building Products, Inc.
c. Hilti Corp.
d. ITW Ramset/Red Head.
e. Powers Fasteners.
f. Simpson Strong Tie Anchor Systems.

3. Post-Tensioned Concrete: For post-tensioned concrete, fasteners shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer's written approval for all proposed fasteners in post-tensioned concrete prior to installation.

F. Mineral-Fiber Insulation for Installations in Sound-Rated Partitions: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6 to 12 lb/cu ft (96 to 192 kg/cu m) density; with following characteristics:

1. Flame-Spread Index: 25 maximum.
2. Smoke Development Index: 50 maximum.
3. Combustion Characteristics: Passing ASTM E 136.

G. Glazing: Comply with Division 08 Section "Glazing".

H. Primer: Fast-curing, corrosion-inhibiting, lead and chromate free, universal primer complying with ANSI A224.1 acceptance criteria; compatible with substrate and field-applied finish paint system specified in Division 09 Section Painting.

I. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing minimum of 94 percent zinc dust by weight.

## 2.4 FABRICATION, GENERAL

A. Fabrication Quality Standard: ANSI/NAAMM-HMMA 861.

B. General Requirements: Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit, and assemble units in manufacturer's plant.

C. Accessories: Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to templates furnished as specified in Division 08 Section "Door Hardware".

1. Locate hardware according to ANSI/NAAMM-HMMA 861.
2. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.5 HOLLOW METAL DOORS

A. Fabrication Provisions: Fabricate doors not less than 1-3/4 in (44 mm) thick, of seamless hollow construction unless otherwise indicated. Construct doors with smooth surfaces without visible joints or seams on exposed faces.

1. Glazed Lites: Factory cut openings in doors.

B. Door Face Sheets:

1. Cold-rolled steel sheet, minimum 0.042 in (1.10 mm) (18 gage) thick for doors in the following locations:

a. Interior doors.

C. Core Construction:

1. Steel-Stiffened Core: 0.026 in (0.7 mm) (22 gage) thick, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 in (150 mm) apart, spot welded to face sheets a maximum of 5 in (125 mm) on centers. Spaces filled between stiffeners with mineral-fiber insulation.
2. Fire Door Core: As required to provide fire-protection indicated.
3. Thermal-Rated (Insulated) Core: Typical at Exterior doors and otherwise indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.4 deg F by h by sq ft/Btu (0.704 K by sq m/W) according to ASTM C 518.

D. Vertical Edges:

1. Single Acting Doors: Beveled 1/8 in in 2 in (3 mm in 50 mm).
2. Double Acting Doors: Round vertical edges with 2-1/8 in (53 mm) radius.

E. Top and Bottom Channels: Closed with continuous channels, minimum 0.053 in (1.3 mm) (16 gage) thick, of same material as face sheets and spot welded to both face sheets.

1. Spot weld metal channel not more than 6 inches (150 mm) on center.

F. Hardware Reinforcement: Fabricate from same material as door. Minimum thickness of steel reinforcing plates for following hardware:

1. Hinges and Pivots: 0.167 in (4.2 mm) (7 gage) thick by 1-1/2 in wide by 6 in (38 mm by 150 mm) longer than hinge, secured by not less than 6 spot welds.
2. Strikes, Flush Bolts, and Closers: 0.093 in (2.3 mm) (12 gage).
3. Surface-Mounted Hold-Open Arms and Panic Devices: 0.093 in (2.3 mm) (12 gage).

G. Glass Molding and Stops: Provide frame for glazed openings between face sheets continuously around perimeter of glass opening and weld to face sheets.

1. Form frame with integrally formed stop on security side.
2. Miter corners, weld, and grind smooth.
3. Do not overlap frame molding on face of door.
4. Use same materials as door face sheet for frame and loose stop for flush glazing.

2.6 HOLLOW METAL FRAMES

A. Fabrication Provisions:

1. Fabricate frames of construction indicated below.
2. Close contact edges of corner joints tight with faces mitered and full-profile continuously welded.

   a. "Knock-down" frame construction is not acceptable and shall not be used.

3. Close contact edges of stops butted or mitered.
4. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

B. Joinery:

1. Fabrication Quality Standard: Head-to-jamb joints according to ANSI/NAAMM-HMMA 820 for either of following fabrication techniques with:

   a. Saw-mitered corners, full-profile continuously welded.
   b. Machine-mitered corners, full-profile continuously welded.

2. Externally or internally weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and seamless.
3. Internally weld rabbet and soffits continuously; grind, fill, dress, and make smooth.
4. Use of gusset or splice plates as substitute for fully welding is not permitted.

C. Materials and Thickness:

1. Cold-rolled steel sheet for frames in the following locations:

   a. Interior frames.

2. Thickness for Cold-Rolled Steel Sheet Frames:

a. 48 in (1200 mm) Wide or Less: 0.053 in (1.3 mm) (16 gage) thick.
b. More than 48 in (1200 mm) Wide: 0.067 inch (1.7 mm) (14 gage) thick.

3. Sidelight and Transom Frames: Closed tubular members with no visible face seams or joints fabricated from same type and thickness of material as adjacent door frame.
4. Interior Borrowed-Light Frames: Fabricated from 0.053 in (1.3 mm) (16 gage) thick cold-rolled steel sheet.

D. Stops and Moldings:

1. Form corners with butted or mitered hairline joints.
2. Provide around glazed lites where indicated.

a. Fixed frame moldings on outside of exterior doors and frames and on secure side of interior doors and frames.
b. Loose stops and moldings on inside of hollow metal work so that glass can be removed independently.

3. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

E. Hardware Reinforcement: Fabricate from same material as frame. Minimum thickness of steel reinforcing plates for following hardware:

1. Hinges and Pivots: 0.167 in (4.2 mm) (7 gage) thick by 1-1/2 in wide by 6 in (38 mm by 150 mm) longer than hinge, secured by not less than 6 spot welds.
2. Strikes, Flush Bolts, and Closers: 0.093 in (2.3 mm) (12 gage).
3. Surface-Mounted Hold-Open Arms and Panic Devices: 0.093 in (2.3 mm) (12 gage).

F. Head Reinforcement: Provide minimum 0.093 in (2.3 mm) (12 gage) thick, steel channel or angle stiffener for opening widths more than 48 in (1200 mm).

G. Jamb Anchors:

1. Types: Fabricated of same material as frame:

a. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 in (1.10 mm) (18 gage) thick.
b. Masonry Type: Adjustable Z-clip type or T-shaped anchors to suit frame size, not less than 0.042 in (1.10 mm) (18 gage) thick, with corrugated or perforated straps not less than 2 in (50 mm) wide by 10 in (250 mm) long.
c. Postinstalled Expansion Type for In-Place Concrete or Masonry: Countersunk, flat or oval head exposed screws and bolts with expansion shields or inserts, minimum 3/8 in (10 mm) diameter bolts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

2. Quantity and Location:

a. Stud-Wall Type: Locate anchors not more than 18 in (450 mm) from top and bottom of frame. Space anchors not more than 32 in (800 mm) on centers and as follows:

1) Three anchors per jamb up to 60 in (1500 mm) high.
2) Four anchors per jamb from 60 to 90 in (1500 to 2250 mm) high.
3) Five anchors per jamb from 90 to 96 in (2250 to 2400 mm) high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 in (600 mm) or fraction thereof above 96 in (2400 mm) high.
5) Two anchors per head for frames above 42 in (1050 mm) wide and mounted in metal-stud partitions.

b. Masonry Type: Locate anchors not more than 18 in (450 mm) from top and bottom of frame. Space anchors not more than 32 in (800 mm) on centers and as follows:

1) Two anchors per jamb up to 60 in (1500 mm) high.
2) Three anchors per jamb from 60 to 90 in (1500 to 2250 mm) high.
3) Four anchors per jamb from 90 to 120 in (2250 to 3000 mm) high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 in (600 mm) or fraction thereof above 120 in (3000 mm) high.

c. Postinstalled Expansion Type for In-Place Concrete or Masonry: Locate anchors not more than 6 in (150 mm) from top and bottom of frame and not more than 26 in (650 mm) on centers.

H. Floor Anchors: Formed from same material as frames welded to bottom of jambs and mullions with not less than 4 spot welds, not less than 0.0428 in (1.10 mm) (18 gage) thick, and as follows, terminating bottom of frames at finish floor surface:

1. Monolithic Concrete Slabs: Clip type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable type anchors with extension clips, allowing not less than 2 in (50 mm) height adjustment.

I. Shipping Spreader Bars: Attach two removable metal spreader bars across bottom of frames, tack welded to jambs and mullions.

J. Door Silencers: Except on weatherstripped doors, drill holes to receive door silencers furnished under Division 08 Section Door Hardware. Keep holes clear during construction.

1. Single-Door Frames: Strike jamb for 3 door silencers.
2. Double-Door Frames: Head jamb for 2 door silencers.

## 2.7 STEEL FINISHES

A. Comply with NAAMM's Metal Finishes Manual for Architectural and Metal Products for recommendations for cleaning, treating, priming, and when specified, finishing.

B. Finish products specified in this Section after fabrication.

C. Metallic-Coated Steel Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to primer to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Non-Coated Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, Solvent Cleaning; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 3, Power Tool Cleaning, or SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.

E. Prime Coat Finish: Apply manufacturer's standard primer specified below immediately after surface preparation and pretreatment.

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

F. Field-Applied Coatings: As specified in Division 09 Section Painting.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

### 3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. ANSI/NAAMM-HMMA 840.
2. NFPA 80 for fire-rated doors and frames.
3. NFPA 105 for smoke control doors and frames.
4. DHI A115.IG.
5. Respective manufacturer's written installation instructions.
6. Accepted submittals.
7. Contract Documents.

### 3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Pre-Installation Tolerances: Prior to installation, adjust and securely brace hollow metal frames for squareness, alignment, twist, and plumbness to following:

1. Squareness: Plus or minus 1/16 in (1.5 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 in (1.5 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 in (1.5 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 in (1.5 mm), measured at jambs on a perpendicular line from head to floor.

C. Hardware Preparation: Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.4 INSTALLATION OF HOLLOW METAL DOORS AND FRAMES

A. Hollow Metal Frames: Install hollow metal frames of size and profile indicated.

1. Setting: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and welded-in shipping spreader bars. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

   a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   b. Install frames with removable glazing stops located on secure side of opening.
   c. Install door silencers in frames before grouting.
   d. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors or powder actuated fasteners.
3. Sound-Rated Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
5. Installation Tolerances: Adjust hollow metal frames for squareness, alignment, twist, and plumb to following:

   a. Squareness: Plus or minus 1/16 in (1.5 mm), measured at rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 in (1.5 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 in (1.5 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 in (1.5 mm), measured at jambs at floor.

B. Hollow Metal Doors: Provide insulated doors at exterior and non-insulated at interior locations. Fit accurately in frames, within following clearances:

1. Jambs and Head: 1/8 in (3 mm) plus or minus 1/16 in (1.5 mm).
2. Between Edges of Pairs of Doors: 1/8 in (3 mm) plus or minus 1/16 in (1.5 mm).
3. Between Bottom of Door and Top of Threshold: Maximum 3/8 in (10 mm).
4. Between Bottom of Door and Top of Finish Floor Covering or Top of Structure (No Threshold): Maximum 3/4 in (19 mm).

C. Glazing:

1. Comply with installation requirements in Division 08 Section Glazing.
2. Secure stops with countersunk flat or oval head machine screws spaced uniformly not more than 6 in (150 mm) on center and not more than 2 in (50 mm) on centers from each corner.

3.5 ADJUSTMENTS

A. Final Adjustments: Remove and replace defective hollow metal work, including work that is warped, bowed, or otherwise unacceptable.

B. Prime Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of primer compatible with paint specified in Division 09 Section "Painting".

C. Field-Applied Coatings: As specified in Division 09 Section Painting.

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 08 1416

PREFINISHED FLUSH WOOD DOORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Prefinished flush wood doors and supplementary items necessary for installation.

### 1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Include details of core and edge construction, light frames, and trim for openings.
3. Include factory-finishing specifications.
4. Include manufacturer's surface preparation instructions.
5. Indicate scheduled fire doors that cannot qualify for labeling because of design, size, hardware or other reason.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Provide dimensioned drawings indicating location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for door face matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection-ratings for fire-rated doors.

C. Samples for Verification Purposes: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Plastic Laminate Doors: Plastic laminate door facing, 6 in (150 mm) square, for each color, texture, and pattern selected.
2. Impact Resistant Panel Doors: Impact resistant panel door facing, 6 in (150 mm) square, for each color, texture, and pattern selected.
3. Corner sections of doors, approximately 8 in by 10 in (200 mm by 250 mm), with door faces and edges representing actual materials to be used.

   a. Plastic Laminate Doors: Samples for each color, texture, and pattern of plastic laminate door facing required.
   b. Impact Resistant Panel Doors: Samples for each color, texture, and pattern of impact resistant panel door facing required.
   c. Finish door facing samples with same materials proposed for factory-finished doors.

4. Light Frames: Frames for light openings, 6 in (150 mm) long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with requirements of referenced quality standards and manufacturer's written instructions.

1. Package doors individually.
2. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration.
3. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Deliver and install doors only when spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. Warranty shall also include finishing that may be required due to repair or replacement of defective doors. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Defects include, but are not limited to, the following:

a. Warping (Bow, Cup, or Twist): Not more than 1/4 in (6 mm) in a 42 by 84 in (1050 by 2100 mm) section.
b. Telegraphing of Core Construction: Not more than 0.01 in in a 3 in (0.25 mm in a 75 mm) span in face veneers.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period as follows:

a. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. Algoma Hardwoods, Inc.
2. Construction Specialties, Inc. (C/S Group)
3. Eggers Industries.
4. Marshfield Door Systems, Inc.
5. Mohawk Flush Doors, Inc.; a Masonite Company.
6. Oshkosh Architectural Door Company.
7. VT Industries Inc.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Fire Resistance Ratings: Products and construction identical to assemblies tested for fire resistance according to NFPA 252 or UL 10C and included under Category GSZN, Category A, published in Underwriters Laboratories, Inc. (UL) "Fire Resistance Directory"; or listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Positive Pressure Testing: After 5 minutes into test, neutral pressure level in furnace shall be established at 40 in (1000 mm) or less above sill.
3. Availability: If specified as fire-rated and labeled door can be obtained from one manufacturer, no consideration will be given to those manufacturers who are not authorized to manufacture such doors.
4. Smoke-Control Door Assemblies: Comply with UL 1784.

2.4 DOOR CONSTRUCTION, GENERAL

A. Product Quality Standard: In addition to standard listed elsewhere, comply with following, unless otherwise specified, for construction, finishes, installation, and other requirements.

1. Quality Standard: Comply with "Architectural Woodwork Standards".

a. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
b. Typical Doors: WDMA I.S.1-A Performance Grade: Heavy Duty, minimum.
c. Impact Resistant Panel-Clad Doors: WDMA I.S.1-A, Performance Grade: Extra Heavy Duty.

B. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

C. Particleboard Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2.
2. Blocking: Provide wood blocking as needed to eliminate through-bolting hardware and as follows:

a. Top Rail: 5 in (125 mm).
b. Bottom Rail: 5 in (125 mm).
c. Mid Rail: 5 in (125 mm), in doors indicated to have exit devices.
d. Lock Blocks: 5 in by 10 in (125 mm by 250 mm), one for lock and two for exit devices.

D. Fire-Protection-Rated Doors: Mineral core as required for fire-protection-rating indicated.

1. Edge: Construction with intumescent seals; where positive pressure fire testing is required, edge construction with intumescent seals concealed by outer stile matching door face material and laminated backing at hinge stiles for improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
2. Pairs: Fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Comply with specified requirements for exposed edges.

E. Structural Composite Lumber Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.
2. Screw Withdrawal, Face: 700 lbf (3100 N).
3. Screw Withdrawal, Edge: 400 lbf (1780 N).

F. Mineral Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection-rating indicated.
2. Blocking: Provide fire resistant composite blocking with improved screw-holding capability approved for use in doors of fire-protection-ratings indicated as needed to eliminate through-bolting hardware and as follows:

a. Top Rail: 5 in (125 mm).
b. Bottom Rail: 5 in (125 mm).
c. Mid Rail: 5 in (125 mm), in doors indicated to have exit devices.
d. Lock Blocks: 5 in by 10 in (125 mm by 250 mm), one for lock and two for exit devices.

2.5 PLASTIC LAMINATE FACED DOORS

A. Interior Solid-Core Doors:

1. Grade: Premium.
2. Plastic Laminate Door Faces:

a. Product Quality Standard: NEMA LD 3, Grade HGS.
b. Description: High-pressure decorative laminates, 0.048 in (1.2 mm) minimum thickness.

3. Plastic Laminate Selection: As scheduled or as indicated in Design Selections.
4. Exposed Vertical and Horizontal Edges: Plastic laminate that matches faces, applied before faces.
5. Core: Particleboard or mineral core as required by application.
6. Construction:

a. Non-Fire-Rated and Fire-Rated (20 minute): 3 plies.

1) Stiles and rails bonded to core.
2) Entire unit abrasive planed before faces are applied.
3) Faces bonded to core using a hot press.

b. Fire-Rated (45 minute and higher): 5 plies.

1) Stiles and rails bonded to core.
2) Entire unit abrasive planed before faces and crossbands are applied.
3) Faces bonded to core using a hot press.

2.6 IMPACT RESISTANT PANEL FACED DOORS

A. Interior Solid-Core Doors:

1. Grade: Premium.
2. Impact Resistant Panel Door Faces: Manufacturer's standard impact resistant panel, 0.040 in (1.0 mm) minimum thickness.
3. Impact Resistant Panel Selection: As scheduled or as indicated in Design Selection.
4. Exposed Vertical Edges:

a. Matching Color Door Stile: Provide one of the following:

1) Impact resistant panel edging that matches faces, applied before faces.
2) Manufacturer's standard replaceable secondary door stile with 0.060 in (1.5 mm) thick impact resistant panel edging that matches faces.

5. Core: Particleboard or mineral core as required by application.

6. Construction: 5 plies

   a. Stiles and rails bonded to core.
   b. Entire unit abrasive planed before faces and crossbands are applied.
   c. Faces bonded to core using a hot press.

2.7 FABRICATION OF PREFINISHED FLUSH WOOD DOORS

A. Fabrication Quality Standards: In addition to standards listed elsewhere, comply with following, unless otherwise specified:

   1. NFPA 80 for fire-rated doors.
   2. DHI-WDHS-3 and DHI A115-W series standards for hardware.

B. Factory Fitting: Factory fit doors to suit frame opening sizes indicated according to installation quality standards. Do not trim stiles and rails in excess of limits permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining with seal coat.

C. Hardware:

   1. Factory machine doors for hardware that is not surface applied according to installation quality standards.
   2. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
   3. For doors scheduled to have electrical locks, provide built-in 1/4 in (6 mm) diameter raceway through doors, from lockset location to nearest hinge location, for low voltage wiring for doors scheduled to have electric locks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

   1. Verify that 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.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

   1. NFPA 80 for fire-rated doors.
   2. NFPA 105 for smoke control doors.
   3. Respective manufacturer's written installation instructions.

4. Accepted submittals.
5. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF FLUSH WOOD DOORS

A. Factory-Fitted Door Clearances: Fit accurately in frames, within following clearances for all doors (smoke control, fire-rated, and non-fire-rated):

1. Jambs and Head: 1/8 in (3 mm) maximum.
2. Between Edges of Pairs of Doors: 1/8 in (3 mm) maximum.
3. Between Bottom of Door and Top of Threshold: Maximum 3/8 in (10 mm).
4. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 in (19 mm).
5. Between Bottom of Door and Top of Finish Surface (No Threshold) when the bottom of the door is more than 38 in (965 mm) above the finished floor: Maximum 3/8 in (10 mm) or as specified by the manufacturer's label service procedure.

B. Hardware: As specified in Division 08 Section "Door Hardware".

C. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.5 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.

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SECTION 08 3113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Access doors and frames and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Ceiling Coordination Drawings for Access Doors at Ceilings: Furnish reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other. Indicate method of attaching door frames to surrounding construction.

D. Samples for Verification Purposes: For each door face material, at least 3 in by 5 in (75 mm by 125 mm) in size, in specified finish.

E. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for vertical access doors and frames.
2. ASTM E 119 or UL 263 for horizontal access doors and frames.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. Metal Doors and Frames:

a. Acudor Products, Inc.
b. Babcock-Davis.
c. Dur-Red Products.
d. J. L. Industries, Inc.
e. Karp Associates, Inc.
f. Larsen's Manufacturing Company.
g. Maxam Metal Products, Ltd.
h. Milcor Inc.
i. Nystrom, Inc.
j. Williams Brothers Corporation of America.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36 / A 36M.

1. ASTM A 123 / A 123M, for galvanizing steel and iron products.
2. ASTM A 153 / A 153M, for galvanizing steel and iron hardware.

B. Steel Sheet: Uncoated cold-rolled steel sheet substrate complying with ASTM A 1008 / A 1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated (Galvanized) Steel Sheet: ASTM A 653 / A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924 / A 924M.

D. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning", to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning", or SSPC-SP 8, "Pickling".
2. Surface Preparation for Metallic-Coated (Galvanized) Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

E. Drywall Beads: Edge trim formed from 0.0299 in (0.7 mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.4 STAINLESS-STEEL MATERIALS

A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.

1. Finish: Directional No. 4 Satin Finish.

2.5 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Non-rated Flush Access Doors and Frames with Exposed Trim:

1. Locations:

a. Masonry wall surfaces.
b. Ceramic tile wall surfaces.

2. Fabricated from one of the following as scheduled at the end of this Section.

a. Steel sheet.
b. Stainless-steel sheet.

3. Door: Minimum 0.075 in (1.9 mm) thick sheet metal, set flush with exposed face flange of frame.
4. Frame: Minimum 0.060 in (1.5 mm) thick sheet metal with 1-1/4 in (32 mm) wide, surface-mounted trim.
5. Hinges: Continuous piano.

6. Lock: Key-operated cylinder.
7. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
8. Basis of Design: Nystrom Building Products, Model NT.

B. Non-rated Flush Access Doors and Trimless Frames:

1. Locations: Wall and ceiling surfaces as scheduled.

   a. Gypsum board wall and ceiling surfaces.
   b. Plaster wall and ceiling surfaces.

2. Fabricated from one of the following as scheduled at the end of this Section.

   a. Steel sheet.
   b. Stainless-steel sheet.

3. Door: Minimum 0.075 in (1.9 mm) thick sheet metal, set flush with surrounding finish surfaces.
4. Frame: Minimum 0.060 in (1.5 mm) thick sheet metal with drywall bead flange.
5. Hinges: Continuous piano.
6. Lock: Key-operated cylinder.
7. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
8. Basis of Design: Nystrom Building Products, Model NW or NP as applicable.

C. Non-rated Recessed Access Doors and Trimless Frames:

1. Locations:

   a. Gypsum board wall and ceiling surfaces.

2. Fabricated from one of the following as scheduled at the end of this Section.

   a. Steel sheet.
   b. Stainless-steel sheet.

3. Door: Minimum 0.060 in (1.5 mm) thick sheet metal in the form of a pan recessed 5/8 in (15 mm) for infill.
4. Frame: Minimum 0.060 in (1.5 mm) thick sheet metal with finishing bead and only frame edge exposed.
5. Hinges: Concealed piano hinge or spring-loaded, concealed-pin type pivoting rod hinge.
6. Lock: Key-operated cylinder with plastic grommet for access through pan recess.
7. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
8. Basis of Design:

   a. Gypsum Board Infill: Nystrom Building Products, Model RW.

D. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim:

1. Locations:

   a. Masonry wall surfaces.
   b. Ceramic tile wall surfaces.

2. Fabricated from one of the following as scheduled at the end of this Section.

   a. Steel sheet.
   b. Stainless-steel sheet.

3. Fire-Resistance Rating: Not less than 1-1/2 hours.
4. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
5. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 in (0.9 mm).
6. Frame: Minimum 0.060 in (1.5 mm) thick sheet metal with 1 in (25 mm) wide, surface-mounted trim.
7. Hinges: Continuous piano.
8. Automatic Closer: Spring type.
9. Latch: Self-latching device operated by flush key with interior release.
10. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
11. Basis of Design: Nystrom Building Products, Model IT.

E. Fire-Rated, Insulated, Flush Access Doors and Trimless Frames:

1. Locations:

   a. Gypsum board wall and ceiling surfaces.

2. Fabricated from one of the following as scheduled at the end of this Section.

   a. Steel sheet.
   b. Stainless-steel sheet.

3. Fire-Resistance Rating: Not less than 1-1/2 hours.
4. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
5. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 in (0.9 mm).
6. Frame: Minimum 0.060 in (1.5 mm) thick sheet metal with drywall bead.
7. Hinges: Continuous piano.
8. Automatic Closer: Spring type.
9. Latch: Self-latching device operated by flush key with interior release.
10. Size: 12 in by 12 in (300 mm by 300 mm); unless otherwise indicated.
11. Basis of Design:

   a. Gypsum Board: Nystrom Building Products, Model IW.

## 2.6 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Gypsum Board Locations: For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
2. Provide mounting holes in frames for attachment of units to metal framing.
3. Provide mounting holes in frame for attachment of masonry anchors.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

### 3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

### 3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.4 INSTALLATION OF ACCESS DOORS AND FRAMES

A. Frames with Masonry Anchors: Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.5 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.6 ACCESS DOOR SCHEDULE

A. Provide access doors where indicated on the drawings and as follows:

1. Steel Access Doors:

   a. Concealed valves and controls for plumbing and HVAC.
   b. Fire dampers above non-accessible ceilings.
   c. Motor operated doors and grilles above non-accessible ceilings.

2. Fire-Rated Steel Access Doors:

   a. Rated walls and ceilings.

3. Stainless Steel Access Doors:

   a. Ceramic tile and other damp locations.

END OF SECTION

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# SECTION 08 3616.13

# BARN (SLIDING) DOORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Sliding Barn Doors - flush wood, aluminum frames and related hardware.

### 1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including installation instructions.

B. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, materials, components, hardware, finish, options, and accessories. Shop Drawings to show required blocking by others.

C. Samples: Submit manufacturer's samples of the following sliding door components:

1. Aluminum Frame finish sample

D. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

E. Warranty Documentation: Submit manufacturer's standard warranty.

### 1.3 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of interior aluminum frames and doors.

B. Source: Obtain sliding aluminum framed doors and hardware from single source.

C. Manufacturer's Qualifications: Manufacturer regularly engaged for past 5 years in manufacture of sliding doors similar to that specified.

### 1.4 PERFORMANCE

A. Aluminum perimeter frames with integral acoustic seals.

B. Soft self-closing mechanism integrated with top track.

C. Concealed door guide.

### 1.5 DELIVERY: STORAGE AND PROTECTION

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Notify manufacturer immediately of any shipping damage.

C. Storage and Handling Requirements:

1. Store and handle materials in accordance with manufacturer's instructions.
2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
3. Store materials in clean, dry area indoors.
4. Protect materials and finish during storage, handling, and installation to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. AD SYSTEMS 2201 100th St. SW, Everett, WA

2.2 INTERIOR SLIDING ALUMINUM-FRAMED DOORS AND PARTITIONS

A. Interior Aluminum-Framed Top-Hung Sliding Doors: Model: AD Systems High Performance ExamSlide Sliding Door System.

B. Specified Wall Thickness: As detailed.

C. Door Leafs. All Doors to be factory machined for hardware including pilot and function holes.

1. 1-3/4" Flush Wood Door: Reference division 08 Section "Prefinished Flush Wood Doors".]

D. Door Components:

1. Single Top Track: AD Systems extruded aluminum track by AD Systems
2. Valances: Extruded aluminum with integral end caps
   a. Standard square valance.
3. Top Rollers: tandem nylon roller sized to match door weight
4. Concealed Floor Guide: Integral Jamb floor guide by AD Systems
5. Soft-Closer: Soft and self-closing damper mechanism at one side of door leaf
6. Handles:
   a. AD Systems Standard Ladder Pull: 16" long x 1" diameter. Finish: US32D Satin Stainless Steel.

E. Accessories:

1. Door Locks:

a. Privacy latch with emergency release.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine wall openings to receive sliding doors for plumb, level, and square. Note: Finish door operation will be affected by out of tolerance framing.

B. Verify dimensions of wall openings.

C. Examine surfaces to receive top and bottom guide.

D. Notify Architect of conditions that would adversely affect installation or subsequent use of sliding doors.

E. Do not begin installation until unacceptable conditions are corrected.

F. Base of door side to be flush or minimal. Rubber Base acceptable.

3.2 INSTALLATION

A. Install sliding doors in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Install sliding doors plumb, level, square, and in proper alignment.

C. Install sliding doors to close against walls without gaps.

D. Install sliding doors to open and close smoothly.

E. Anchor sliding doors securely in place to supports. Required: Fire treated 2 x 6 blocking required full length of track.

3.3 ADJUSTING

A. Adjust sliding doors for proper operation in accordance with manufacturer's instructions.

B. Adjust sliding doors to operate smoothly without binding.

C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

3.4 CLEANING

A. Clean sliding doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that could damage materials or finish.

3.5 PROTECTION

A. Protect installed sliding doors from damage during construction.

END OF SECTION

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EL PASO, TEXAS

SECTION 08 4110

INTERIOR STOREFRONT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Interior storefront (interior glazed aluminum partitions) and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.3 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS qualification requirements and the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

1.4 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.5 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. EFCO Corporation, a Pella Company.
2. Kawneer North America; an Alcoa Company.
3. Oldcastle BuildingEnvelope.
4. YKK AP America Inc.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Kawneer North America; an Alcoa Company; Trifab VG 450, 1-3/4 in (44 mm) face, 4-1/2 in (113 mm) depth, glass in center.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials

2.3 PERFORMANCE REQUIREMENTS

A. Structural Loads: Provide glazed aluminum partition systems capable of withstanding uniform load of 5 lbs per sq. ft. (25 kg/square m) based on testing manufacturer's standard system in assemblies similar to those indicated for this Project.

1. Deflection of framing members normal to wall plane is limited to 1/175 of clear span for spans up to 13 ft 6 in (4 m) and to 1/240 of clear span plus 1/4 in (6 mm) for spans greater than 13 ft 6 in (4 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 in (19 mm) whichever is less.

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 / B 209M.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 / B 221M.
3. Extruded Structural Pipe and Tubes: ASTM B 429 / B 429M.
4. Structural Profiles: ASTM B 308 / B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Internal Steel Reinforcement for High Spans: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

C. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 GLAZING

A. Glazing: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Comply with Division 08 Section "Glazing".

2.6 FABRICATION

A. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

B. Framing Members: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
6. Fabricate for flush glazing (without projecting stops).

C. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

1. Provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

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

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 EXAMINATION

A. Examine substrate surfaces to receive glazed aluminum partitions and associated work and conditions under which work will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of surface conditions.

3.5 INSTALLATION OF GLAZED ALUMINUM PARTITIONS

A. General:

1. Do not install damaged components.
2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
3. Rigidly secure non-movement joints.
4. Install anchors with separators and isolators to prevent impediments to movement of joints.

5. Do not cut, trim, weld or braze component parts during erection, in any manner which would damage finish, decrease strength or result in visual imperfection or failure in performance of construction.
6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints within glazed aluminum framing system according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

B. Install components plumb and true in alignment with established lines and grades, and without warp or rack. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers.

C. Install glazing as specified in Division 08 Section "Glazing".

3.6 ERECTION TOLERANCES

A. Erection Tolerances: Install to comply with the following non-accumulating maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 in (3 mm) in 12 ft (3 mm in 3.7 m); 1/4 in (6 mm) over total length.
2. Alignment:

   a. Where surfaces abut in line, limit offset from true alignment to 1/16 in (1.5 mm).
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 in (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 in (3 mm).

END OF SECTION

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SECTION 08 4216

# INTERIOR ALUMINUM ENTRANCE DOORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Interior aluminum entrance doors and supplementary items necessary for installation.

### 1.2 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities".

### 1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of aluminum entrance door hardware, as well as procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

### 1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS qualification requirements and the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum".

B. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

### 1.5 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. EFCO Corporation, a Pella Company.
2. Kawneer North America; an Alcoa Company.
3. Oldcastle BuildingEnvelope.
4. YKK AP America Inc.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Aluminum Entrance Door System; Medium Stile: Kawneer 350 Standard Entrances.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 / B 209M.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 / B 221M.
3. Extruded Structural Pipe and Tubes: ASTM B 429 / B 429M.
4. Structural Profiles: ASTM B 308 / B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

2.4 GLAZING

A. Glazing: Provide glass of types and thicknesses indicated. Fabricate glass to sizes required for openings indicated with edge clearances and tolerances complying with manufacturer's recommendations. Comply with Division 08 Section "Glazing".

## 2.5 ALUMINUM ENTRANCE DOOR SYSTEMS

A. Standard-Duty Aluminum Entrance Doors: Manufacturer's standard-duty manual-swing operation entrance door system.

1. Door Construction: 1-3/4 in (44.5 mm) overall thickness, with minimum 0.125 in (3.2 mm) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Medium stile; 3-1/2 in (88.9 mm) nominal width at vertical stiles.

   a. Accessible Doors: Smooth surfaced for width of door in area within 10 in (255 mm) above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets. Provide non-removable glazing stops on outside of door.
4. Door Hardware: As specified in Division 08 Section "Door Hardware".

## 2.6 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum entrance doors, as specified in Division 07 Section "Joint Sealants".

B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30 mils (0.762 mm) thickness per coat.

## 2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Welds shall be of adequate strength and durability, with jointing tight, flush, smooth and clean. Weld behind finished surfaces so as to cause no distortion and/or discoloration on the finished side. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that is sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing. Provide minimum clearances and depth of glazing packets as recommended by glass manufacturer for thickness and type of glass indicated.
6. Fasteners, anchors, and connection devices that are concealed from view.

D. Door Frames: Provide tubular and channel frame entrance door frame assemblies, as indicated, with welded or mechanical joints in accordance with manufacturer's standards. Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

E. Reinforce doors as required for installing entrance door hardware.

F. Hardware Installation: Factory-install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

2.8 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 accepted 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 accepted Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.

2. Accepted submittals.
3. Contract Documents.

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

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF ALUMINUM ENTRANCE DOORS

A. General:

1. Do not install damaged components.
2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
3. Rigidly secure non-movement joints.
4. Install anchors with separators and isolators to prevent impediments to movement of joints.
5. Do not cut, trim, weld or braze component parts during erection, in any manner which would damage finish, decrease strength or result in visual imperfection or failure in performance of construction.
6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints within glazed aluminum framing system according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

B. Install components plumb and true in alignment with established lines and grades, and without warp or rack. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers.

C. Install doors to produce smooth operation and tight fit at contact points.

1. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

D. Install glazing as specified in Division 08 Section "Glazing".

3.5 ERECTION TOLERANCES

A. Erection Tolerances: Install to comply with the following non-accumulating maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 in in 12 ft (3 mm in 3.7 m); 1/4 in (6 mm) over total length.
2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 in (1.5 mm).
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 in (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 in (3 mm).

3.6 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 in (75 mm) from the latch, measured to the leading door edge.

END OF SECTION

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 08 7100

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Items commercially known as finish or door hardware required for operation of doors, and accessories necessary to complete installation.

B. Products Furnished But Not Installed Under this Section: Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1. Cylinders for locks. (Owner Furnished)

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each item of door hardware indicated, specified, or required.

B. Including material descriptions, dimensions of individual components and profiles, finishes, and installation instructions.

1. Index product data sheets according to hardware schedule by use of numbers or letters, or combination.

C. Shop Drawings for Electrified Hardware:

D. Wiring Diagrams: Indicate power, signal, and control wiring detailed in following forms distinguishing between manufacturer-installed and field-installed wiring:

1. System schematic.

a. Point-to-point wiring diagrams.
b. Riser diagrams.
c. Door elevations.

2. Interface: Details between electrified hardware and fire alarm, access control, security, and building control system.
3. Sequence of Operation: Narrative operation description of doors controlled by electrified hardware.

E. Hardware Set Schedules: Prepared by suppliers AHC detailing fabrications and assembly of door hardware, as well as procedures and diagrams. Coordinate hardware sets with doors, frames, and related Work to ensure proper size, thickness, hand, function, and finish of item.

F. Format: Use same numbering shown on Drawings and Schedules.

1. Content: Organize into hardware sets indicating designations of each item required for

each door or opening. Include following information:

2. Type, style, function, size, and finish of each item.

    1) Manufacturer and product number of each item.
    2) Fastenings and other pertinent attachment information.
    3) Location of each set cross referenced to room name and number in which door serves.
    4) Explanation of abbreviations, symbols, and codes contained in schedule.
    5) Mounting locations for hardware.
    6) Door and frame sizes and materials.

3. Additional Specific Information: Include type of strike plates; length of spindle, hand, backset and bevel of locks; hand and degree opening for closers; length of kickplates; length of rods for flush bolts; type of door stop; and other functions of mechanisms.

G. Keying Schedule: Submit indicating Owner's instructions for keying of locks.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certification for Electrified Hardware: Written data from product manufacturer certifying electrified hardware is approved for use on types and sizes of labeled fire rated doors comply with listed fire rated door assemblies.

B. Product Test Reports: Written reports for extended cycle testing based on evaluation of comprehensive tests performed by manufacturer or other qualified testing facility and witnessed by a qualified testing agency, for locksets, exit devices and closers.

C. Manufacturers Project Acceptance Document: Certification that products are approved, acceptable, or suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that warranty will be issued.

1.4 CLOSE-OUT SUBMITTALS

A. Operation and Maintenance Data: For inclusion in operation and maintenance manual required by Division 01, submit manufacturer's instructions for operation and maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

B. Operational and Maintenance Training: Training materials, including instructor qualifications, required by Close-Out Activities Article.

C. Maintenance Tools and Instructions: Furnish complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.5 FIELD QUALITY CONTROL

A. Engage qualified, independent, Door Hardware Institute (DHI) Certified, Fire Door Assembly Inspector (CFDAI) or Architectural Hardware Consultant (AHC) to perform inspections, prepare inspection reports, and issue inspection reports.

1. Representative will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.
2. Representative will inspect fire rated doors and state in report whether installed work complies with NFPA 80.

1.6 QUALITY ASSURANCE

A. Supplier Qualifications:

1. Experience: Architectural door hardware supplier that has record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.
2. Staff Hardware Expertise: Experienced professional currently certified by DHI as AHC, CDC, and EHC, and experienced in door hardware installations that are comparable in material, design, and extent to this Project that will be responsible for following activities:
3. Preparation of submittals, including hardware set schedules.

    a. Available for consultation to Owner, Architect, and Contractor during course of Work.
    b. Finalizing keying requirements with Owner.

4. Electro-Mechanical or Electronic Hardware: When supplied, technician, with minimum of 5 years of experience in low voltage installation, shall be available for assistance to Owner, Architect, Contractor, and Installer.

B. Installer Qualifications:

1. Experience: Company with not less than 10 years of experience in performing specified Work similar to scope of this Project; with a record of successful in-service performance; and sufficient capability, facilities and personnel, to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer Training: Technical representatives of manufacturer of locksets, exit devices and closers shall train Installer's installation personnel (supervisor and installers), either at Project or at manufacturers facility, on following:
4. Proper installation of products.

    a. Proper sequence of installation of Work.
    b. Situations that require special attention or care during installation.
    c. Situations and conditions that should be avoided.
    d. Other topics relevant to installation.

C. Pre-Construction Extended Performance Testing: Manufacturer shall, through its own laboratory testing facilities witnessed and verified by Intertek, Underwriters Laboratories, Inc., or other testing laboratory agency acceptable to Architect, perform pre-construction testing to establish compliance of proposed Work with specified requirements.

D. General Requirements: Test hardware items identified in PART 2 for extended cycle performance.

1. Test Method: ANSI/BHMA Grade 1.
2. Reports: Prepare certified reports tabulating test results and indicating if hardware items meet or exceed requirements.
3. Equivalent Option to Testing: Testing not required if manufacturers has tested hardware items within previous 5 years.

E. Keying Conference: Before beginning Work of this Section, conduct conference at Project to comply with requirements of applicable Division 01 Sections. Incorporate keying conference decisions into final keying schedule.

F. Required Attendees:
   a. Owner.
   b. Architect.
   c. Contractor, including supervisor.
   d. Supplier's architectural hardware consultant.
   e. Hardware installer, including supervisor.
   f. Owner's Security installer, including supervisor.
   g. Manufacturer's technical representative.

G. Minimum Agenda:

   a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
   b. Preliminary key system schematic diagram.
   c. Requirements for key control system.
   d. Address for delivery of keys.

H. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

I. Pre-Installation Conference: Before beginning Work of this Section, conduct conference at Project to comply with requirements of applicable Division 01 Sections.

J. Required Attendees:

   a. Architect.
   b. Contractor, including supervisor.
   c. Supplier's architectural hardware consultant.
   d. Hardware installer, including supervisor.
   e. Owner's Security installer, including supervisor.
   f. Manufacturer's technical representative.

K. Minimum Agenda: Installer shall demonstrate understanding of Work required by reviewing and discussing procedures for, but not limited to, following:

   a. Tour representative areas of required Work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of installation and other preparatory Work performed by other installers.
   b. Review Contract Document requirements.
   c. Review approved submittals.
   d. Review installation procedures, including, but not limited to, following:

e. Installation requirements for each hardware item.

1) Sequence of operation for each type of electrified door hardware
2) Relationships between electrified hardware and fire alarm, access control, security, and building control system.

f. Review required inspection, testing, certifying, and material usage accounting procedures.
g. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

L. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.7 WARRANTY

A. Manufacturer's Special Warranty: Furnish labor and material warranty for following time periods from date of substantial completion agreeing to repair or replace defects, faulty Work and failures, signed by authorized representative using manufacturer's standard form.

1. Mortise Locksets: 5 years on mechanical components with 2 years on electrical components.
2. Exit Devices: 5 years on mechanical components with 2 years on electrical components.
3. Overhead Manual Closers: 10 years.
4. Floor Closers: 5 years.
5. Electrified Hardware: 2 years
6. Electromagnetic and Delayed-Egress Locks: 5 years.

B. Require Third Party Inspection on all Life Safety Doors for NFPA compliance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Sections.

B. Basis of Design: Contract Documents are based on products specified in PART 3 "Door Hardware Sets" Article below to establish a standard of quality. Other listed manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and does not change intent of Contract Documents as judged by Architect.

2.2 HARDWARE, GENERAL

A. Single Source Responsibility: Furnish each type of hardware unit from single manufacturer. Electrified door hardware shall be from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

B. Manufacturer's Nameplate: Hardware units shall not have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire rated labels; manufacturer's identification is permitted on rim of lock cylinders only.

C. Base Metals: Hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

D. Fasteners: Hardware units manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

E. Concealed Fasteners: Hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is only means of securely attaching hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

1. Steel Machine or Wood Screws: For following fire rated applications:

   a. Mortise hinges to doors.
   b. Strike plates to frames.
   c. Closers to doors and frames.

2. Steel Through Bolts: For following fire rated applications unless door blocking is provided:

   a. Surface hinges to doors.
   b. Closers to doors and frames.
   c. Surface mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow metal doors.
4. Fasteners for Wood Doors: DHI WDHS.2.

F. Fire-Test-Response Characteristics:

1. Fire Rated Door Assemblies: 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 NFPA 252.
2. Test Pressure: After 5 minutes into test, neutral pressure level in furnace shall be established at 40 in (1000 mm) or less above sill.
3. UL Stickers to be taken off the non-rated doors.

G. Accessibility Requirements: Hardware units and installation shall comply with Americans with Disabilities Act (ADA), ANSI A 117.1, and state and local accessibility standards.

H. Electrical Requirements: Furnish electrical products that are listed and classified by UL as suitable for purpose specified and indicated.

1. Electrified Functions: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
2. Concealed Plug Connectors: Termination of multi-wire bundles up to 8 conductors shall be by 8 position concealed plug connector or by 8 position and 4 position connector for 12 wire applications.
3. Fail Safe in case of power loss.

2.3 BUTT HINGES

A. Product Quality Standard: ANSI/BHMA A 156.1, Grade 1, 2 or 3.

B. Description:

1. Generic Type: Full-mortise, concealed bearings.
2. Weight:
3. Doors with Closers: Heavy anti-friction bearing.

   a. Doors without Closers: Standard plain bearing.

4. Hinge Pins: Except as otherwise indicated, hinge pins as follows:
5. Out-Swing Exterior Doors: Non-removable pins (NRP) or safety stud.

   a. Out-Swing Corridor Doors with Locks: Non-removable pins (NRP) or safety stud.
   b. Interior Doors: Non-rising pins.
   c. Top Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.
   d. Bottom Tips: Hole in bottom for easy pin removal.

C. Templates: Except for hinges to be installed entirely (both leaves) into wood doors and wood frames, provide only template-produced units.

D. Screws: Phillips flat-head screws with heads to match surface of hinges.

E. Metal Doors and Metal Frames: Machine screws installed into drilled and tapped holes.
1. Wood Doors and Wood Frames: Wood screws.
2. Fire Rated Wood Doors: No. 12 by 1-1/4 in (32 mm), threaded-to-head steel wood screws.

F. Basis of Design, Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.

G. Manufacturers:

1. Hager
2. Ives
3. McKinney
4. Stanley

2.4 CONTINUOUS GEARED HINGES

A. Product Quality Standard: ANSI/BHMA A 156.26, Grade 1, 2 or 3.

B. Description: Extruded-aluminum, pinless, geared hinge leaves; joined by a continuous

extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings; type scheduled in PART 3 "Door Hardware Sets" Article. Steel pins to hold labeled fire rated doors in place if required by tested listing.

C. Screws: Phillips flat-head screws with heads to match surface of hinges. Comply with following:

1. Metal Doors and Metal Frames: Machine screws installed into drilled and tapped holes.
2. Wood Doors and Wood Frames: Wood screws.
3. Fire Rated Wood Doors: No. 12 by 1-1/4 in (32 mm), threaded-to-head steel wood screws.

D. Basis of Design, Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.

E. Manufacturer:

1. Ives Hardware
2. ABH

2.5 FLUSH BOLTS

A. Manual Flush Bolts:

1. Product Quality Standards:

a. ANSI/BHMA A 156.16.
b. Underwriters Laboratories, Inc. listed for fire doors.

B. Description:

1. Minimum 1/2 in (12 mm) round rods, forged brass or bronze, furnished in pairs, (top and bottom of door); lengths of rod 12 in (300 mm); where door is higher than 84 in (2.13 m), top bolt shall be of sufficient length to locate flush bolt operator 72 in (1.83 m) above finish floor.

a. Standard top strike and dustproof bottom strike.

2. Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.
3. Manufacturers and Products:

a. Ives
b. Trimco

C. Automatic Flush Bolts:

1. Product Quality Standards:

a. ANSI/BHMA A 156.16.
b. Underwriters Laboratories, Inc. listed for fire doors.

D. Description:

1. Minimum 1/2 in (12 mm) round rods, forged brass or bronze, furnished in pairs, (top and

bottom of door); lengths of rod 12 in (300 mm); where door is higher than 84 in (2.13 m), top bolt shall be of sufficient length to locate flush bolt operator 72 in (1.83 m) above finish floor.

a. Standard top strike and dustproof bottom strike.

2. Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.
3. Manufacturers and Products:

a. Ives
b. Trimco

E. Constant Latching Flush Bolts:

1. Product Quality Standards:

a. ANSI/BHMA A 156.16.
b. Underwriters Laboratories, Inc. listed for fire doors.

F. Description:

1. Constant latching flush bolt at top remaining engaged when active door is opened, retracting only when plunger on face of bolt is depressed.

a. Automatic flush bolt at bottom.
b. Standard top strike and dustproof bottom strike.

2. Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.
3. Manufacturers and Products:

a. Ives

2.6 CYLINDERS

A. Cylinders/ IC Cores: ANSI/BHMA A 156.5, Grade 1 unless Grade 2 is indicated.

B. Manufacturer and Product:

1. Best (No Substitutions)

2.7 KEYING

A. Interchangeable Core Cylinders including construction and permanent cores.

B. Manufacturer and Product:

1. Best (No Substitutions)

2.8 BORED LOCKSETS AND LATCHES

A. Product Quality Standards: ANSI/BHMA A 156.2, Grade 1, except cycle testing shall be 2 million

cycles minimum.

1. NFPA 101 in means of egress.
2. Underwriters Laboratories, Inc. listed for fire rated doors.

B. Product Quality Standards: ANSI/BHMA A 156.2, Grade 1, except cycle testing shall be 1 million cycles minimum. Grade 2 may be used for certain applications as scheduled.

1. NFPA 101 in means of egress.
2. Underwriters Laboratories, Inc. listed for fire rated doors.

C. Description:

1. Bored Box Construction:

a. Interlocking construction between lockbody and latchbolt tube.
b. 2-3/4 in (69 mm) backset.
c. 2-1/4 in (56 mm) by 1 in (25 mm) front.
d. Minimum 1/2 in (12 mm) latchbolt throw, or as required for fire rated doors.
e. Provision to prevent lever from sagging.

2. Strikes: Metal strike plate with metal or plastic strike box with extended lip to protect frame.

a. Single Swing Doors: Minimum lip projection necessary to project from trim.
b. Pairs of Doors: With or without astragal, lip projection not beyond face of lock style of inactive leaf.

D. Basis of Design, Function, Accessories, Lever Base Metal, Face Plate, Rose, and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.

E. Manufacturer and Product:

1. Best (No Substitutions)

2.9 EXIT DEVICES

A. Product Quality Standards: ANSI/BHMA A 156.3, Grade 1, except extended cycle performance testing shall be 8 million cycles minimum.

1. NFPA 101 in means of egress.
2. Underwriters Laboratories, Inc. listed for fire rated doors.
3. Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
4. NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

B. Description:

1. Touch bar type, unless scheduled otherwise.

2. Concealed vertical rods on pairs of doors, unless surface mounted vertical rods required for fire rated doors.
3. Mortise lock or rim type devices on single doors only.
4. Outside trim as scheduled in PART 3 "Door Hardware Sets" Article.
5. Except on fire rated doors where closers are provided on doors equipped with exit devices, equip units with keyed dogging device to keep latch bolt retracted, when engaged.
6. Except at doors with thresholds, provide vertical rod devices which hold rods in retracted position when door is open.

C. Basis of Design, Function, Accessories, Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.

D. Manufacturers and Products:
1. Von Duprin
2. Sargent

2.10 ELECTROMAGNETIC LOCKS

A. Product Quality Standard: ANSI/BHMA A 156.23.

B. Description: Full exterior or interior type, electrically powered electromagnet attached to frame and armature plate attached to door; strength ranking, inductive kickback peak voltage, and residual magnetism.

C. Basis of Design, Function, Accessories, Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.

D. Manufacturers:

1. Schlage Electronics
2. Door Controls International

2.11 DELAYED EGRESS LOCKS

A. Product Quality Standard: ANSI/BHMA A 156.24.

B. Description: Full exterior or interior type, electrically powered electromagnet attached to frame and armature plate attached to door; strength ranking, inductive kickback peak voltage, and residual magnetism.

1. Means of Egress Doors: Lock releases within 15 seconds after applying a force not more than 15 lbf (67 N) for not more than 3 seconds, as required by NFPA 101.
2. Security Grade: Activated from secure side of door by initiating device.
3. Movement Grade: Activated by door movement as initiating device.

C. Basis of Design, Function, Accessories, Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.

D. Manufacturers:

1. Schlage Commercial Electronics

2. Door Controls International

2.12 PUSH/PULL TRIM

A. Product Quality Standard: ANSI/BHMA A 156.6.

B. Description:

1. Flat Push Plates: 0.050 in (1.3 mm) thick, 4 in wide by 16 in high (100 mm) wide by (400 mm) high); with square corners and beveled edges, secured with exposed screws.
2. Pull-Plate Door Pulls: 0.050 in (1.3 mm) thick plate, 4 in wide by 16 in high (100 mm) wide by (400 mm) high), with square corners and beveled edges; 3/4 in (19 mm) constant-diameter pull, with minimum clearance of 1-1/2 in (38 mm) from face of door; fastened at 8 in (200 mm) o.c., secured with exposed screws.

C. Basis of Design, Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.

D. Manufacturer:

1. Ives
2. Trimco

2.13 CLOSERS

A. Product Quality Standard: ANSI/BHMA A 156.4, Grade 1, except cycle testing shall be 6 million cycles minimum.

B. Description: Manual overhead surface and concealed closers. Cast Iron body.

C. Size of Units: Except as otherwise specifically indicated, comply with manufacturer's recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.

D. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible, provide adjustable units complying with accessibility requirements for door opening force and delayed action closing.

E. Basis of Design, Function, Accessories, Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.

F. Surface Closers Manufacturer and Model Series:

1. LCN (No Substitutions)

2.14 STOPS AND HOLDERS

A. Product Quality Standard:

1. Stops and Bumpers: ANSI/BHMA A 156.16, Grade 1.
2. Overhead Stays: ANSI/BHMA A 156.16, Grade 1.
3. Electromagnetic Door Holders: BHMA A 156.15; coordinate with fire detectors and

interface with fire alarm system for fire rated doors.
4. Door Silencers: ANSI/BHMA A 156.16.

B. Basis of Design, Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.

C. Emergency Release Stops:

D. Description: Retractable stop to permit doors to be opened in both directions without damage to frame for emergency rescue.

1. Manufacturer and Product:

a. Ives
b. Trimco

2.15 PROTECTIVE TRIM UNITS

A. Product Quality Standard: ANSI/BHMA A 156.6.

B. Description: Minimum 0.050 in (1.25 mm) thick metal plates with beveled top and 2 sides fabricated in following configurations:

1. Armor Plates: 36 in (900 mm) high by door width, with allowance for frame stops.
2. Kick Plates: 10 in (250 mm) high by door width, with allowance for frame stops.
3. Mop Plates: 6 in (150 mm) high by 1 in (25 mm) less than door width.
4. Door Edging:

a. Angle: 7/8 in (21 mm) legs by 42 in (1050 mm) high mortised into door edge.
b. Cap: 7/8 in (21 mm) legs by thickness of door by 42 in (1050 mm) high mortised into door edge.

C. Fasteners: Exposed fasteners consisting of either machine screws or self-tapping screws.

D. Width and Thickness: As scheduled in PART 3 "Door Hardware Sets" Article.

E. Basis of Design, Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.

F. Manufacturer and Product:

1. Ives
2. Trimco

2.16 DOOR GASKETING

A. Product Quality Standards: ANSI/BHMA A 156.22, and according to following when required:

1. Air Leakage: Not to exceed 0.50 cfm/ft (0.000774 cu m/s/m) of crack length for gasketing other than for smoke control according to ASTM E 283.
2. Smoke Leakage: Comply with NFPA 105 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated according to UL 1784.

3. Fire Rating: Comply with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction according to NFPA 252. After 5 minutes into test, neutral pressure level in furnace shall be established at 40 in (1000 mm) or less above sill.
4. Sound Rating: Listed and labeled by a testing and inspecting agency according to ASTM E 1408.

B. Basis of Design: As scheduled in PART 3 "Door Hardware Sets" Article.

C. Manufacturer:

1. Zero
2. National Guard Products
3. Reese

2.17 THRESHOLDS

A. Product Quality Standard: ANSI/BHMA A 156.21.

B. Basis of Design: As scheduled in PART 3 "Door Hardware Sets" Article.

C. Manufacturer:

1. Zero
2. National Guard Products

2.18 KEY CONTROL SYSTEM

A. Key Control Cabinet:

B. Product Quality Standard: BHMA A156.5, Grade 1.

1. Description: Metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of number of locks.
2. Multiple-Drawer Cabinet: Cabinet with drawers equipped with key-holding panels and key envelope storage, and progressive-type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.

C. Manufacturers:

1. Key Control Systems
2. Lund Equipment Co
3. MMF Industries
4. Sunroc Corporation

D. Key Control System Software:

E. Product Quality Standard: BHMA A156.5, Grade 1.

1. Description: Multiple-index system for recording and reporting key-holder listings,

tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.

2.19 MISCELLANEOUS DOOR HARDWARE

A. Boxed Power Supplies:

B. Description: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.

1. Basis of Design, Function, Accessories, Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.

C. Auxiliary Hardware:

D. Product Quality Standard: BHMA A156.16, Grade 1.

1. Basis of Design, Function, Accessories, Base Metal and Finish: As scheduled in PART 3 "Door Hardware Sets" Article.
2. Manufacturers:

a. Hager
b. Ives
c. Trimco

E. Silicone Sealant: Exterior non-sag silicone sealant as specified in Division 07 Section "Joint Sealants."

2.20 FINISHES

A. Product Quality Standard: ANSI/BHMA A 156.18, as scheduled in PART 3 "Door Hardware Sets" Article.

B. Protection: 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 range of approved samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine doors and frames to receive door hardware and associated Work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as

acceptance of surface conditions.

B. Any doors not listed without hardware set(s) should apply set C714 until clarified.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.
4. ANSI/DHI A 115.IG.

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

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Steel Doors and Frames: Comply with DHI A115 Series.

C. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A 250.6.

D. Wood Doors: Comply with DHI A115-W Series.

E. Electrical: Verify raceway system and other provisions for electrical power are adequate for electrified door hardware installation.

3.4 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.

B. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."

C. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

D. Hardware Installation:

1. Set hardware items level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
3. Do not install surface-mounted hardware items until finishes have been completed on substrates involved.

E. Key Control System: Tag keys and place on markers and hooks in cabinet, as determined by final keying schedule.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect. Provide one power supply for each door opening.

G. Control Wiring:

1. Raceways: As specified and provided under appropriate Division 26 Section.
2. Connections: Coordinate with appropriate Division 28 Section.

H. Thresholds: Set thresholds for exterior and acoustical doors in full bed of silicone sealant complying with requirements specified in Division 07 Section "Joint Sealants." Extend full width of opening and notch at door stops.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

B. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

C. Engage qualified, independent, Door Hardware Institute (DHI) Certified, Fire Door Assembly Inspector (CFDAI) or Architectural Hardware Consultant (AHC) to perform inspections, prepare inspection reports, and issue inspection reports.

D. Representative will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

E. Representative will inspect fire rated doors and state in report whether installed work complies with NFPA 80.

F. Inspection and testing must comply with NFPA 101-2012: 7.2.1.5.10.1; 7.2.1.2.11, NFPA 80-2010: 4.8.4; 5.2.1; 5.2.3; 5.2.6; 5.2.7; 6.3.1.7, NFP 105-2010: 5.2.1, EC.02.03.05, and EP 25 & EP 28

3.6 ADJUSTMENTS

A. Post-Occupancy Adjustment: Approximately 6 months after date of substantial completion, qualified technicians of supplier or installer, accompanied by manufacturers technical representatives of locksets, exit devices, closers, and other hardware manufacturers as required, shall perform following Work:

1. Examine and adjust each item of hardware as necessary to restore proper function of doors

and hardware to comply with specified requirements.

2. Replace hardware items that have deteriorated or failed due to faculty design, materials, or installation.

B. Maintenance Service:

1. First Year Maintenance Service: Beginning at date of substantial completion, supplier or installer shall provide 12 months maintenance service by qualified technicians.
2. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper hardware operation.

   a. Provide parts and supplies same as those used in manufacture and installation of original products.

C. Proposal for Continuing Maintenance Service: Before expiration of first year maintenance service term, supplier shall furnish Owner with continuing maintenance service agreement, renewable yearly, proposing services, obligations, conditions, and terms for continuing maintenance service.

3.7 CLOSE-OUT ACTIVITIES

A. Operational and Maintenance Training: Train Owner's personnel on maintenance, operation, and adjustment of door hardware at Project using factory-trained and certified technicians. Provide attendees with bound copies of training materials.

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Hardware Group No. 201

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | STOREROOM LOCK | 93K7D 14C | 626 | BES |
| 1 | EA | SFIC CORE | SFIC CORE - KEYED TO MATCH EXISTING | 626 | BES |
| 1 | EA | SURFACE CLOSER | 4040XP RW/PA X MTG BRKT, SPCR & PLATE AS REQ | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

Hardware Group No. 301

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | PRIVACY SET | 93KOL 14C | 626 | BES |
| 1 | EA | SURFACE CLOSER | 4040XP RW/PA X MTG BRKT, SPCR & PLATE AS REQ | 689 | LCN |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

Hardware Group No. 307

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | PRIVACY SET | 93KOL 14C | 626 | BES |
| 1 | EA | OH STOP | 900S SERIES X SIZE & MOUNTING AS REQ | 630 | GLY |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

Hardware Group No. 401

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | PASSAGE SET | 93KON 14C | 626 | BES |
| 1 | EA | SURFACE CLOSER | 4040XP RW/PA X MTG BRKT, SPCR & PLATE AS REQ | 689 | LCN |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

Hardware Group No. 401A

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | PASSAGE SET | 93KON 14C | 626 | BES |
| 1 | EA | SURFACE CLOSER | 4040XP RW/PA X MTG BRKT, SPCR & PLATE AS REQ | 689 | LCN |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | SET | SEAL | PERIMETER SEAL BY FRAME MANUFACTURER | | |

Hardware Group No. 403

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | PASSAGE SET | 93KON 14C | 626 | BES |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

Hardware Group No. 403S

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | PASSAGE SET | 93KON 14C | 626 | BES |
| 1 | EA | OH STOP | 100S SERIES X SIZE & MOUNTING AS REQ | 630 | GLY |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

Hardware Group No. 403SCS

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1SC 5 | 652 | IVE |
| 1 | EA | PASSAGE SET | 93KON 14C | 626 | BES |
| 1 | EA | OH STOP | 100S SERIES X SIZE & MOUNTING AS REQ | 630 | GLY |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

Hardware Group No. 403W

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1HW 5 X 4.5 | 652 | IVE |
| 1 | EA | PASSAGE SET | 93KON 14C | 626 | BES |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

Hardware Group No. AC720DRW

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 6 | EA | HINGE | 5BB1HW 5 X 4.5 | 652 | IVE |
| 2 | EA | POWER TRANSFER | EPT10 CON | 689 | VON |
| 1 | EA | ELEC FIRE EXIT HARDWARE | RX-QEL-9847-EO-F-LBR-CON (WDC @ WD) LENGTH AND HEIGTH AS REQ | 626 | VON |
| 1 | EA | ELEC FIRE EXIT HARDWARE | RX-QEL-9847-EO-F-LBR-CON (WDC @ WD) LENGTH AND HEIGTH AS REQ | 626 | VON |
| 1 | EA | SFIC CYLINDER | SFIC CYLINDER - TYPE AS REQ - WITH KEYED CONST CORE | 626 | BES |
| 1 | EA | SFIC CORE | SFIC CORE - KEYED TO MATCH EXISTING | 626 | BES |
| 1 | EA | DELAYED EGRESS MAG | M490DEP MTG BRKT & VOLTAGE AS REQ | 628 | SCE |
| 2 | EA | AUTO OPERATOR | DC7000 WITH ACTUATORS - TYPE AS REQ | 689 | DCI |
| 2 | EA | KICK PLATE | 8400 10" X 1" LDW B-CS | 630 | IVE |
| 2 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | MEETING STILE | 328AA-S | AA | ZER |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |
| 4 | EA | HARNESS (1 IN DOOR & 1 IN FRAME) | ALLEGION CONNECT TYPE & LENGTH AS REQ | | SCH |
| 2 | EA | HARNESS (TO POWER SUPPLY) | CON-6W - CONNECTION LEADS | | SCH |
| 2 | EA | CREDENTIAL READER | CREDENTIAL READER BY ANOTHER SECTION | | |
| 1 | EA | KEY SWITCH | 653-SERIES X L2 - MAGNETIC LOCK RESET | 630 | SCE |
| 2 | EA | DOOR CONTACT | 679-05 TYPE AS REQ | WHT | SCE |
| 1 | EA | POWER SUPPLY | POWER SUPPLY FOR CARD READER BY ANOTHER SECTION | | |
| 1 | EA | POWER SUPPLY | PS902 900-FA 900-4RL 120/240 VAC (COORDINATE PS WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS) | | VON |

Hardware Group No. AD01

Provide each SL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 1 | EA | SLIDING DOOR | OFFICESLIDE SYSTEM, SECTION 08 34 00 | | ADS |

Hardware Group No. C200

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 5 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | ELECTRIC HINGE | 5BB1 4.5 X 4.5 CON TW8 | 652 | IVE |
| 1 | SET | AUTO FLUSH BOLT | FB31P/FB41P AS REQ | 630 | IVE |
| 1 | EA | DUST PROOF STRIKE | DP2 | 626 | IVE |
| 1 | EA | STOREROOM LOCK | 93K7D 14C | 626 | BES |
| 1 | EA | SFIC CORE | SFIC CORE - KEYED TO MATCH EXISTING | 626 | BES |
| 1 | EA | ELECTRIC STRIKE (SGL DOOR - HMF) | 6200 SERIES FSE-CON (FAIL SECURE) VOLTAGE AS REQ | 630 | VON |
| 1 | EA | COORDINATOR | COR X FL X MB X HW PREPS X LENGTH AS REQUIRED | 628 | IVE |
| 2 | EA | SURFACE CLOSER | 4040XP RW/PA X MTG BRKT, SPCR & PLATE AS REQ | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 1" LDW B-CS | 630 | IVE |
| 2 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | MEETING STILE | 8193AA (2 PCS - 1 SET) HEIGHT AS REQUIRED (OMIT @ NON-RATED DOORS) | AA | ZER |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |
| 2 | EA | HARNESS (1 IN DOOR & 1 IN FRAME) | ALLEGION CONNECT TYPE & LENGTH AS REQ | | SCH |
| 1 | EA | HARNESS (TO POWER SUPPLY) | CON-6W - CONNECTION LEADS | | SCH |
| 1 | EA | CREDENTIAL READER | CREDENTIAL READER BY ANOTHER SECTION | | |
| 2 | EA | DOOR CONTACT | 679-05 TYPE AS REQ | WHT | SCE |
| 1 | EA | POWER SUPPLY | POWER SUPPLY FOR CARD READER BY ANOTHER SECTION | | |
| 1 | EA | POWER SUPPLY | PS902 120/240 VAC (COORDINATE PS WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS) | LGR | SCE |

Hardware Group No. C201

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | STOREROOM LOCK | 93K7D 14C | 626 | BES |
| 1 | EA | SFIC CORE | SFIC CORE - KEYED TO MATCH EXISTING | 626 | BES |
| 1 | EA | ELECTRIC STRIKE (SGL DOOR - HMF) | 6200 SERIES FSE-CON (FAIL SECURE) VOLTAGE AS REQ | 630 | VON |
| 1 | EA | SURFACE CLOSER | 4040XP RW/PA X MTG BRKT, SPCR & PLATE AS REQ | 689 | LCN |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |
| 2 | EA | HARNESS (1 IN DOOR & 1 IN FRAME) | ALLEGION CONNECT TYPE & LENGTH AS REQ | | SCH |
| 1 | EA | HARNESS (TO POWER SUPPLY) | CON-6W - CONNECTION LEADS | | SCH |
| 1 | EA | CREDENTIAL READER | CREDENTIAL READER BY ANOTHER SECTION | | |
| 1 | EA | DOOR CONTACT | 679-05 TYPE AS REQ | WHT | SCE |
| 1 | EA | POWER SUPPLY | POWER SUPPLY FOR CARD READER BY ANOTHER SECTION | | |
| 1 | EA | POWER SUPPLY | PS902 120/240 VAC (COORDINATE PS WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS) | LGR | SCE |

Hardware Group No. C290H

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 5 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | ELECTRIC HINGE | 5BB1 4.5 X 4.5 CON TW8 | 652 | IVE |
| 1 | SET | AUTO FLUSH BOLT | FB31P/FB41P AS REQ | 630 | IVE |
| 1 | EA | DUST PROOF STRIKE | DP2 | 626 | IVE |
| 1 | EA | STOREROOM LOCK | 93K7D 14C | 626 | BES |
| 1 | EA | SFIC CORE | SFIC CORE - KEYED TO MATCH EXISTING | 626 | BES |
| 1 | EA | ELECTRIC STRIKE (SGL DOOR - HMF) | 6200 SERIES FSE-CON (FAIL SECURE) VOLTAGE AS REQ | 630 | VON |
| 1 | EA | COORDINATOR | COR X FL X MB X HW PREPS X LENGTH AS REQUIRED | 628 | IVE |
| 2 | EA | SURFACE CLOSER | 4040XP RW/PA X MTG BRKT, SPCR & PLATE AS REQ | 689 | LCN |
| 2 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 2 | EA | FIRE/LIFE WALL MAG | SEM7800 SERIES AS REQ | 689 | LCN |
| 1 | EA | MEETING STILE | 8193AA (2 PCS - 1 SET) HEIGHT AS REQUIRED (OMIT @ NON-RATED DOORS) | AA | ZER |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |
| 2 | EA | HARNESS (1 IN DOOR & 1 IN FRAME) | ALLEGION CONNECT TYPE & LENGTH AS REQ | | SCH |
| 1 | EA | HARNESS (TO POWER SUPPLY) | CON-6W - CONNECTION LEADS | | SCH |
| 1 | EA | CREDENTIAL READER | CREDENTIAL READER BY ANOTHER SECTION | | |
| 2 | EA | DOOR CONTACT | 679-05 TYPE AS REQ | WHT | SCE |
| 1 | EA | POWER SUPPLY | POWER SUPPLY FOR CARD READER BY ANOTHER SECTION | | |
| 1 | EA | POWER SUPPLY | PS902 120/240 VAC (COORDINATE PS WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS) | LGR | SCE |

Hardware Group No. CX711

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 1 | EA | CONT. HINGE | 112XY EPT HEIGHT AS REQ | 628 | IVE |
| 1 | EA | POWER TRANSFER | EPT10 CON | 689 | VON |
| 1 | EA | DELAYED FIRE EXIT HARDWARE | CXR98-L-NL-F-06-SNB 24 VDC | 626 | VON |
| 1 | EA | SFIC CYLINDER | SFIC CYLINDER - TYPE AS REQ - WITH KEYED CONST CORE | 626 | BES |
| 1 | EA | SFIC CORE | SFIC CORE - KEYED TO MATCH EXISTING | 626 | BES |
| 1 | EA | SURFACE CLOSER | 4040XP RW/PA X MTG BRKT, SPCR & PLATE AS REQ | 689 | LCN |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |
| 1 | EA | HARNESS (1 IN DOOR & 1 IN FRAME) | ALLEGION CONNECT TYPE & LENGTH AS REQ | | SCH |
| 1 | EA | HARNESS (TO POWER SUPPLY) | CON-6W - CONNECTION LEADS | | SCH |
| 2 | EA | CREDENTIAL READER | CREDENTIAL READER BY ANOTHER SECTION | | |
| 1 | EA | DOOR CONTACT | 679-05 TYPE AS REQ | WHT | SCE |
| 1 | EA | POWER SUPPLY | POWER SUPPLY FOR CARD READER BY ANOTHER SECTION | | |
| 1 | EA | POWER SUPPLY | PS902 900-FA 900-2RS 120/240 VAC (COORDINATE PS WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS) | | VON |

Hardware Group No. K901

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | KEYPAD LOCK | POWER PLEX 2000 - TYPE AS REQ | 626 | KAB |
| 1 | EA | SFIC CORE | SFIC CORE - KEYED TO MATCH EXISTING | 626 | BES |
| 1 | EA | SURFACE CLOSER | 4040XP RW/PA X MTG BRKT, SPCR & PLATE AS REQ | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

Hardware Group No. K901CH

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 1 | EA | CONT. HINGE | 112XY HEIGHT AS REQ | 628 | IVE |
| 1 | EA | KEYPAD LOCK | POWER PLEX 2000 - TYPE AS REQ | 626 | KAB |
| 1 | EA | SFIC CORE | SFIC CORE - KEYED TO MATCH EXISTING | 626 | BES |
| 1 | EA | SURFACE CLOSER | 4040XP RW/PA X MTG BRKT, SPCR & PLATE AS REQ | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

Hardware Group No. K903

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | KEYPAD LOCK | POWER PLEX 2000 - TYPE AS REQ | 626 | KAB |
| 1 | EA | SFIC CORE | SFIC CORE - KEYED TO MATCH EXISTING | 626 | BES |
| 1 | EA | WALL STOP | WS406/407CCV | 630 | IVE |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

Hardware Group No. K903S

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | KEYPAD LOCK | POWER PLEX 2000 - TYPE AS REQ | 626 | KAB |
| 1 | EA | SFIC CORE | SFIC CORE - KEYED TO MATCH EXISTING | 626 | BES |
| 1 | EA | OH STOP | 100S SERIES X SIZE & MOUNTING AS REQ | 630 | GLY |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

Hardware Group No. K907

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | KEYPAD LOCK | POWER PLEX 2000 - TYPE AS REQ | 626 | KAB |
| 1 | EA | SFIC CORE | SFIC CORE - KEYED TO MATCH EXISTING | 626 | BES |
| 1 | EA | OH STOP | 100S SERIES X SIZE & MOUNTING AS REQ | 630 | GLY |
| 1 | EA | SURFACE CLOSER | 4040XP RW/PA X MTG BRKT, SPCR & PLATE AS REQ | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | SEALS | 188S H & J (USE SILENCERS @ NON-RATED DOORS) | BK | ZER |

**General Notes to be included:**

- Keypads are self-charging keypad (no battery operated – low voltage that recharges)
- Pin Code is 710 Best Compatible Core
- DCS7000 motor
- General Note on all the motors:
    - interface to communicate with security (computer board on operator? CONTROL SEQUENCE)

END OF SECTION

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SECTION 08 7121

# INTERIOR AUTOMATIC DOOR OPERATORS FOR STAFF USE

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Low-energy door operators for swinging doors and supplementary items necessary for installation for the following:

1. Low-Energy Door Operators: For interior prefinished flush wood swinging doors used primarily for staff on a continuous use.
2. Activation Device:

   a. Push-plate switch.

### 1.2 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.

C. For automatic door terminology, see BHMA A156.19 for definitions of terms.

### 1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, including activation devices and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work

1. Indicate required clearances, method of field assembly, components, and location and size of each field connection.
2. Include locations and elevations of entrances showing activation and safety devices.
3. Wiring Diagrams: For power, signal, and activation- and safety-device wiring.
4. Include plans, elevations, sections, details, and attachments to other work for guide rails.

C. Samples: For each exposed product and for each color and texture specified, manufacturer's standard in size.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

C. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For automatic door operators, including activation and safety devices, to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Certified Inspector Qualifications: Certified by the AAADM.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

D. Exit-Door Requirements: Comply with requirements of authorities having jurisdiction for doors with automatic door operators serving as a component of a required means of egress.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of door frames by field measurements before fabrication of exposed covers for automatic door operators.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Templates: Obtain and distribute, to the parties involved, templates for doors, frames, operators, and other work specified to be factory prepared and reinforced for installing automatic door operators. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.

C. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies and, where indicated, access-control system.

1.10 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" are defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, the following:

a. Faulty or sporadic operation of automatic door operator, including activation and safety devices.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Two years from date of Substantial Completion.

1.11 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of automatic door operator Installer. Include quarterly planned and preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

1. Engage a certified inspector to perform safety inspection after each adjustment or repair, and at end of maintenance period. Furnish completed inspection reports to Owner.
2. Include 24-hour-per-day, seven-day-per-week emergency callback service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. Besam, Div of ASSA ABLOY Entrance Systems; SW200 Series.
2. LCN Closers; Div of Allegion plc (formerly Ingersoll-Rand); Senior Swing Series.
3. record USA; 8100 Series
4. Stanley Access Technologies, LLC; Magic-Force Series.

B. Source Limitations: Obtain automatic door operators, including activation devices, from single source from single manufacturer.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with standards indicated below:

1. Sheet: ASTM B 209 (ASTM B 209M).
2. Extrusions: ASTM B 221 (ASTM B 221M).

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, non-bleeding fasteners and accessories compatible with adjacent materials.

2.3 AUTOMATIC DOOR OPERATORS, GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated; and complying with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.

1. Fire-Rated Doors: Where indicated, provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

B. Hinges: See Division 08 Section "Door Hardware" for type of hinge for each door that door operator shall accommodate.

C. Cover for Surface-Mounted Operators: Fabricated from 0.125 in (3.2 mm) thick extruded or formed aluminum; manufacturer's standard width; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

D. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.

E. Fire-Door Package: If indicated, provide fire-door package consisting of UL-listed latch mechanism, power-reset box, and caution signage for fire-rated doors. Latch mechanism shall allow door to swing free during automatic operation; when fire is detected, latch actuator shall cause exit hardware to latch when door closes. Provide latch actuators with fail-secure design.

F. 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.

2.4 LOW-ENERGY DOOR OPERATORS

A. Standard: BHMA A156.19.

B. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf (67 N) required to release a latch if provided, not more than 30 lbf (133 N) required to manually set door in motion, and not more than 15 lbf (67 N) required to fully open door.
2. Entrapment Protection: Not more than 15 lbf (67 N) required for preventing stopped door from closing or opening.

C. Configuration: Operator to control single or pair of swinging doors and as follows.

1. Traffic Pattern: Two way traffic and door configuration as indicated on drawings.
2. Operator Mounting: Surface.

D. Operation: Power opening and spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

E. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation including spring closing when power is off.

F. Microprocessor Control Unit: Solid-state controls.

G. Features:

1. Adjustable opening and closing speed.
2. Adjustable opening and closing force.
3. Adjustable backcheck.
4. Adjustable hold-open time from zero to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Obstructions recycle.

H. Exposed Finish: As specified elsewhere in this specification section.

2.5 ACTIVATION DEVICES

A. General: Provide activation devices in accordance with BHMA standards, for condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

B. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator.

1. Configuration: Square push plate with 4 by 4 in (100 by 100 mm) junction box.

a. Mounting: Recess-mounted, semi-flush in wall.

2. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.

3. Message: "Push to Open."
4. Location: Locate as indicated on drawings, but a minimum of 4 ft. (1.2 m) from door.

C. Proximity Readers: Where indicated, provide wiring, contacts, and related materials to allow for operation of door operating system by owner-provided proximity reader.

D. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.6 FABRICATION

A. Factory-fabricate automatic door operators to comply with indicated standards.

B. Fabricate exterior components to drain water passing joints and condensation and moisture occurring or migrating within operator enclosure to the exterior.

C. Form aluminum shapes before finishing.

D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

E. Provide metal cladding, completely cladding visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

2.7 ACCESSORIES

A. Signage: As required by cited BHMA standard for the type of operator.

1. Application Process: Door manufacturer's standard process.
2. Provide sign materials with instructions for field application when operators are installed.
3. Signage with logo of manufacturer is not acceptable.

2.8 GENERAL FINISH REQUIREMENTS

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

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Apply organic and anodic finishes to formed-metal after fabrication unless otherwise indicated.

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

2.9 ALUMINUM FINISHES

A. Door Operator Exposed Finish: Finish exposed components with finish matching door and frame specified in other specification sections and complying with appropriate requirement as follows:

1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.

C. Verify that full-height finger guards are installed at each door with pivot hinges where door has a clearance at hinge side greater than 1/4 in (6 mm) and less than 3/4 in (19 mm) with door in any position.

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

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

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

C. General: Install complete automatic door operators according to manufacturer's written instructions, including activation and safety devices, control wiring, and remote power units if any; connection to the building's power supply; and signage.

1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.

2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.
3. Low-Energy Door Operator Installation Standard: BHMA A156.19.

D. Power Connection: See Division 26 Sections for connection to electrical power distribution system and see Division 22 Sections for connection to compressed-air distribution piping.

E. Activation Devices: Install devices and wiring according to manufacturer's written instructions and cited BHMA standard for type of operator and direction of pedestrian travel. Connect activation-device wiring according to Division 26 low-voltage Section.

F. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 FIELD QUALITY CONTROL

A. Certified Inspector: Engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.

B. Perform the following tests and inspections:

1. Test and inspect each automatic door operator installation, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

C. Automatic door operators will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

B. After completing installation of exposed, factory-finished automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.

C. Readjust automatic door operators after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

D. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators.

END OF SECTION

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SECTION 08 8020

INTERIOR GLASS AND GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes glass, glazing and supplementary items necessary to complete the installation of interior glazing.

1.2 DEFINITIONS

A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

1.3 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Source Limitations for Glass: Obtain glass from one manufacturer for each type of glass product indicated.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

D. Fire-Rated Door Assemblies: 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 NFPA 252.

E. Fire-Rated Window Assemblies: 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 NFPA 257.

F. Safety Glass:

1. Products Not Permitted: Wired Glass.
2. Acceptable Products: Complying with CSPC 16 CFR 1201, Category II.
3. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specific product, material or manufacturer listed under each item below is "acceptable" only if manufacturer can evidence product compliance with requirements of Contract Documents.

2.2 PRIMARY FLOAT GLASS

A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), and Quality q3 (glazing select), Class 1 (clear) unless otherwise as indicated in schedule.

1. Acceptable Manufacturers:

a. AFG Industries
b. Guardian Industries Corporation
c. Pilkington Libbey-Owens-Ford
d. PPG Industries, Inc. (PPG)

B. Decorative Glazing: As scheduled in Design Selections.

2.3 HEAT-TREATED FLOAT GLASS

A. Fabrication Process: By horizontal (roller-hearth) process. Maintain maximum surface compression for heat strengthened glass of 7500 psi.

B. Heat-Treated Float Glass: ASTM C 1048, Condition A (uncoated surfaces), Type I (transparent glass, flat), Quality q3 (glazing select), kind and class as indicated below.

1. Kind HS (heat strengthened) where indicated or recommended by manufacturer to comply with system performance requirements specified.
2. Kind FT (fully tempered) where indicated or required for safety glazing.
3. Class 1 (clear) unless otherwise indicated in schedule.

2.4 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.

B. Fire-Protection-Rated Laminated Glass: Laminated glass made from 2 plies of clear glass; 5/16 in (8 mm) total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Manufacturers and Products:

a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite Plus
b. Oldcastle Glass, Inc.; Pyroguard
c. Schott North America, Inc.; Pyran Star L
d. Vetrotech Saint-Gobain; SGG Keralite FR-L

2. Locations: Where indicated on drawings for 20-, 45-, 60-, 90-, and 120-minute ratings where safety glazing is required.

2.5 ELASTOMERIC GLAZING SEALANTS

A. Provide Medium-Modulus Neutral-Curing Silicone Glazing Sealant products complying with the following:

1. Acceptable Manufacturers and Products:

a. Dow Corning; 795
b. GE Silicones; Silglaze II
c. Pecora Corporation; 895

2. Type and Grade: S (single component) and NS (nonsag).
3. Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.
4. Use Related to Exposure: NT (nontraffic)
5. Color: As selected from manufacturer's full range of colors.

B. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

C. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

D. Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant including those referencing ASTM C 920 classifications for type, grade, class, and uses.

1. Additional Movement Capability: Provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

E. Glazing Sealant for Fire-Resistive Glazing Products: Identical to product used in test assembly to obtain fire-protection rating.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by glazing material manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.8 FABRICATION

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Minimum required face or edge clearances.
3. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass and glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Provide glazing channel dimensions necessary for bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

G. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

H. Set tempered glass so that tong marks are concealed within frame or furnish horizontal tempered glass without tong marks.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening. Do not remove release paper from tape until just before each glazing unit is installed.

C. 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.

3.5 SEALANT GLAZING

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

C. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

D. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 GASKET GLAZING (DRY)

A. Fabricate 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. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.7 PROTECTION AND CLEANING

A. Protect glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

3.8 GLASS SCHEDULE (Refer to Drawings)

3.9 GLAZING SCHEDULE

A. Tape Glazing:

1. Interior door glass lites
2. Interior borrowed lights less than 75 united inches

B. Sealant and Tape Glazing:

1. Interior borrowed lights greater than 75 united inches.

C. Compression Gasket Glazing:

1. Interior store fronts

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 08 8130

GLAZING ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work of this Section includes glazing accessories, installation materials and supplementary items necessary to complete the work required for their installation.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each product and glazing material specified.

C. Verification Samples: For each finish product specified, two samples representing actual

D. Maintenance data for glazing accessories to include in the operation and maintenance manual specified in Division 1.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Single-Source Responsibility: Obtain each type of glazing accessories from one source and by a single manufacturer for each product and installation method indicated.

1.4 PERFORMANCE REQUIREMENTS

A. Fire Performance: Surface burning characteristics when tested in accordance ASTM E 84:

1. Flame Spread: 25, maximum.
2. Smoke Developed: 450, maximum.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing accessories to comply with manufacturer's directions and as needed to prevent damage to materials.

1.6 PROJECT CONDITIONS

A. Space Enclosure and Environmental Limitations: Do not install glazing accessories until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1.7 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty signed by manufacturer and Installer agreeing to replace decorative glass units that do not meet requirements or that deteriorate as defined in this Section within the specified warranty period. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to manufacturer's published instructions.

1. Warranty Period: 5 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Following manufacturers listed are "acceptable" only if manufacturer can evidence product compliance with requirements of Contract Documents.

1. Glazing Film:

3M Window Films.

B. For manufacturers not listed, submit as substitution according to the Conditions of the Contract and Division 1 Specification Sections.

2.2 GLAZING ACCESSORY PRODUCTS

A. Glass Film: Material of type indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after installation.

1. Ultraviolet Rejected (ASTM E 903): Not less than 99 percent.
2. Film Material Color or Pattern: Where manufacturer's standard products are indicated, provide interlayer material complying with the following requirements:

a. Colors, textures, and patterns indicated by referencing manufacturer's standard designations for these characteristics.
b. Fasara line, as selected by Architect

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

### 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. Install in accordance with manufacturer's instructions.

B. 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.

C. 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.

D. Apply film to glass and lightly spray film with slip solution.

E. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.

F. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.

G. 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.

### 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.

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SECTION 08 8300

UNFRAMED MIRRORED GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes the following types of unframed mirrored glass, typically indicated as mirror Type "S", and supplementary items necessary to complete their installation.

1. Annealed Float Glass Mirrors: Located at public restrooms.
2. Tempered Float Glass, Film-Backed Mirrors or Laminated Mirrors: Located where safety glazing is indicated or required.
3. Film-Backed Annealed Glass Mirrors: Located where safety glazing is indicated or required and providing minimal distortion.

B. Related Section:

1. Metal framed mirror units are specified in Division 10 Section "Toilet Accessories."

1.2 DEFINITIONS

A. Deterioration of Silvered Mirrored Glass: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning silvered mirrored glass contrary to mirrored glass manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Include product data for mirror mastic and mirror hardware.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples: For the following products, in sizes indicated below:

1. Mirrors: 12 in (300 mm) square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
3. Mirror Trim: 12 in (300 mm) long.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in mirrored glass

installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Glazing Publications: Comply with published recommendations in GANA's "Glazing Manual," unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.

C. NAAMM's Publication: For silvered mirrored glass, comply with recommendations in NAAMM's "Mirrors, Handle with Extreme Care, Tips for the Professional on the Care and Handling of Mirrors."

D. Safety Glass: For film-backed, laminated or tempered mirrors provide Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

E. Preconstruction Mirror Mastic Glass Coating Compatibility Test: Submit mirror mastic products to organic protective coating manufacturer for testing to determine compatibility of adhesive with mirrored glass coating.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to mirrored glass manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirrored glass manufacturer's written instructions for shipping, storing, and handling mirrored glass as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrored glass until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 WARRANTY

A. Manufacturer's Special Warranty: Written warranty made out to Owner and signed by mirrored glass manufacturer agreeing to replace silvered mirrored glass units that deteriorate as defined in Definitions Article.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.2 SILVERED FLAT GLASS MIRRORS

A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

B. Clear Glass: Mirror Select Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission.

1. Nominal Thickness: 1/4 in (6 mm).

C. Tempered Clear Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.

1. Nominal Thickness: 1/4 in (6 mm).

D. Laminated Mirrors: ASTM C 1172, Type II.

1. Glass for Outer Lite: Annealed float glass, Mirror Select Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission.

a. Nominal Thickness for Outer Lite: 1/8 in (3 mm).

2. Glass for Inner Lite: Annealed float glass; ASTM C 1036, Type I (transparent flat glass), Quality-Q3; Class 1 (clear).

a. Nominal Thickness: 1/8 in (3 mm).

3. Interlayer: Mirror manufacturer's standard 0.030 in (0.756 mm) thick, clear polyvinyl-butyral interlayer with a proven record of showing no tendency to delaminate from, or cause damage to, silver coating.

2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Neoprene, 70 to 90 Shore A hardness.

B. Edge Sealer: Coating compatible with glass coating and approved by mirrored glass manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrored glass by spot application, certified by both mirrored glass manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrored glass will be installed.

D. Top and Bottom Trim: Stainless steel J-channels formed with a return deep enough to produce a glazing channel to accommodate mirrored glass units of thickness indicated and in lengths required to cover bottom edge of each mirrored glass unit in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 in (10 and 21 mm) in height, respectively, and a thickness of not less than 0.05 in (1.25 mm).
2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 in (15 and 25 mm) in height, respectively, and a thickness of not less than 0.062 in (1.6 mm).
3. Fastener Holes: Minimum 6 in (150 mm) on center with countersunk face for flush screw application, slotted holes for top trim.
4. Finish: No. 4 satin finish, Type 304 stainless steel.

E. Fasteners: Stainless steel flat head machine screws.

F. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls.

G. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 FABRICATION

A. Silvered Mirrored Glass: Float glass with successive layers of chemically deposited silver, electrically or chemically deposited copper, and manufacturer's standard organic protective coating applied to second glass surface to produce a coating system complying with FS DD-M-411.

B. Mirrored Glass Sizes: Cut mirrored glass to final sizes and shapes to suit Project conditions.

C. Cutouts: Fabricate cutouts for notches and holes in mirrored glass without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrored glass.

D. Mirrored Glass Edge Treatment: Treat edges as indicated below:

1. Seamed (swiped) edge when butted against wall, flat polished edge when edge is exposed.
2. Seal edges of silvered mirrored glass after edge treatment to prevent chemical or atmospheric penetration of glass coating.
3. Require mirrored glass manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

E. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.
4. Referenced GANA and NAAMM publications.

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

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. General: Mount mirrored glass accurately in place in a manner that avoids distorting reflected images.

B. Provide space for air circulation between back of mirrored glass units and face of mounting surface.

C. Install permanent means of support at bottom and top edges with bottom support designed to withstand mirrored glass weight and top support designed to prevent mirrored glass from coming away from wall along top edges.

1. Unless otherwise indicated, install continuous bottom and top trim. Fabricate trim in single lengths to fit and cover top and bottom edges of mirrored glass units.
2. Attach mirror hardware securely to steel back up plates with mechanical fasteners and anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrored glass units.
3. For continuous bottom supports, provide setting blocks 1/8 in (3 mm) thick by 4 in (100 mm) long at quarter points. For channel supports in which water could be trapped between setting blocks, provide two slotted weeps not less than 1/4 in (6 mm) wide by 3/8 in (10 mm) long.

4. Place a felt or plastic pad between back of mirrored glass and each fastener to prevent spalling of mirrored glass edges or damaging mirror backing.
5. Exercise extreme caution to avoid scratching silvering on mirror back during installation. Mirrors which are scratched, cracked, chipped or in any manner damaged shall be removed and replaced with new, undamaged mirrors.

D. Mastic Spot Installation System: In addition to top and bottom trim supports, install mirrored glass units with mastic as follows:

1. Apply barrier coat to mirrored glass backing where approved in writing by manufacturers of mirrored glass and backing material.
2. Apply mastic in spots to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrored glass units and face of mounting surface.
3. After mastic is applied, align mirrored glass units and press into place while maintaining a minimum air space of 1/8 in (3 mm) between back of mirrored glass and mounting surface.

3.5 PROTECTION AND CLEANING

A. Protect mirrored glass from breakage and contaminating substances resulting from construction operations.

1. Do not permit edges of silvered mirrored glass to be exposed to standing water.
2. Maintain environmental conditions that will prevent silvered mirrored glass from being exposed to moisture from condensation or other sources for continuous periods of time.

B. Wash mirrored glass before date scheduled for inspections intended to establish date for Substantial Completion. Wash mirrored glass by methods recommended in NAAMM publication and in writing by mirrored glass manufacturer. Use water and glass cleaners free from substances capable of damaging mirrored glass edges or coatings.

END OF SECTION

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EL PASO, TEXAS

SECTION 08 8816

BETWEEN GLASS BLINDS UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this section includes aluminum-framed between glass blind unit glazed into metal framing system (hollow metal or aluminum as indicated on drawings) and supplementary items necessary to complete its installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Samples for Initial Selection: Manufacturer's standard size samples, but not less than 1 inch square, showing the full range of color, texture, and pattern variations expected.

D. Samples for Verification: For the following products, prepared on Samples from the same material to be used for the Work.

1. Louver Slat: Not less than 12 in (300 mm) long.

1.3 INFORMATIONAL SUBMITTALS

A. Window Treatment Schedule: Include between glass blinds in schedule using same room designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For between glass blinds to include in maintenance manuals. Include the following:

1. Methods for maintaining between glass blinds and finishes.
2. Operating hardware.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install blinds until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 5 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers/Fabricators and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers/fabricators offering products that may be incorporated into the Work include, but are not limited to, those listed.

1. Unicel Architectural; Viulite, Model SL20P (Tilt Only, Dual Operator).

2.2 MATERIALS

A. Clear Tempered Glass: ASTM C1048, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select, Kind FT fully tempered.

B. Louvers: Manufacturer's standard aluminum mini-blinds, 1/8 in (3 mm) wide by 0.008 in (0.2 mm) thick with crowned profile. Head and bottom rails same color as slats. Side rails to support head rail and provide spacing between blind and inside surface of glass.

1. Color: As selected from manufacturer's standard colors.

2.3 FABRICATION

A. Integral Louver Blinds Unit: 1 in (25 mm) thick insulated glass unit consisting of two 1/8 in (3 mm) tempered glass lites sandwiched with mini-blinds in air space; blinds to be tilted via external ADA-compliant device both sides of door (unless indicated otherwise) having a force to tilt blinds of less than 2.25 lbf (10 N).

B. Sealed Insulating Glass Units: Comply with ASTM E774.

1. Sealing System: Seal with manufacturer's standard sealant.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

C. Operating Mechanism: Manufacturer's standard operating mechanism for operating blinds (tilt only) from either side of unit, except at psychiatric units; ADA-compliant mounting height.

D. Unit Configuration (Tempered Unit):

1. Outer Lite: 1/8 in (3 mm) thick clear tempered glass.
2. Airspace: 3/4 in (19 mm).
3. Inner Lite: 1/8 in (3 mm) thick clear tempered glass.

E. Tolerances:

1. Space of approximately 1/8 in (3 mm) on each side between slats and spacer, for free movement of system and allowing thermal transmission of aluminum slats.
2. Blind Width Tolerance: Plus zero; minus 1/16 in (1.5 mm).
3. Blind Height Tolerance: Plus 3/8 in (9 mm); minus zero. Bottom rail engages pins in sidetrack with some slack and is slightly above lower spacer bar.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Preparation: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

C. Remove protective film, clean glass, and verify operation of operating mechanism to produce optimum tilt operation for smooth slat rotation of blinds.

D. Remove nonpermanent labels, and clean surfaces.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Protect insulating glass blind system units from damage immediately after installation by attaching crossed streamers to framing held away from glazing unit. Do not apply markers to security glazing surfaces.

B. Protect insulating glass blind system units from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with insulating glass blind system units, remove substances immediately as recommended in writing by insulating glass blind system manufacturer.

C. Remove and replace insulating glass blind system units that are broken, chipped, cracked, or abraded or that are damaged from natural causes, accidents, or vandalism during construction period.

D. Wash insulating glass blind system units on exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash insulating glass blind system units as recommended in writing by insulating glass blind system manufacturer.

END OF SECTION

# SECTION 09 2900

# GYPSUM BOARD ASSEMBLIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Metal framing systems, interior gypsum board faced walls, partitions, and ceiling assemblies, and supplementary items necessary for installation.

### 1.2 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms not defined in this Section or in other referenced quality standards.

B. Damage: Stored or installed gypsum board materials shall be classified as defective and nonconforming Work if they have been exposed to wetness or dampness at any time prior to Substantial Completion or if they exhibit evidence of active or dormant mold or mildew.

### 1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings:

1. Include scaled and dimensioned drawings showing locations of control joints.
2. Gypsum Board Location Schedule: Provide detailed schedule in format similar to "Gypsum Board Schedule" at end of this Section indicating gypsum board products to be installed and their respective locations.

### 1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction Test Reports for Acoustical Sealant: Compatibility test reports from sealant manufacturer indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility with sealants; include sealant manufacturer's certification of test results for sealant compatibility and recommendations for primers and substrate preparation needed to obtain adhesion and prevent corrosion of substrate.

### 1.5 QUALITY ASSURANCE

A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.
b. Field Samples for Gypsum Board Finishing: Build 10 ft (3 m) square gypsum board (attached to metal studs) area for each finish level specified. Include not less than one tapered-to-tapered edge gypsum board joint and cut edge-to-cut edge gypsum board joint.

2. Clean exposed faces of mock-up.
3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Protect accepted mock-up from the elements with weather-resistant membrane.
6. Obtain Architect's acceptance of mockups before starting fabrication.
7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
8. Acceptance of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

B. Fire Resistance Rated Assembly Characteristics: Provide materials and construction identical to those tested according to ASTM E 119/NFPA 251/UL 263 by one of following independent testing and inspecting agency as evidenced by design designation included in their associated approval manual:

1. UL - "Fire Resistance Directory", Category BXUV.
2. GA 600 - "Fire Resistance Design Manual".
3. Other agency acceptable to authorities having jurisdiction.

C. Smoke Resistance Rated Assembly Characteristics: Provide materials and construction identical to those tested according to indicated fire resistance rated assemblies by independent testing and inspecting agency acceptable to authorities having jurisdiction.

D. Sound (STC) Resistance Rated Assembly Characteristics: Provide materials and construction identical to those tested according to ASTM E 90 and classified according to ASTM E 413 by independent and testing agency acceptable to authorities having jurisdiction.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 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.

1.8 PROJECT CONDITIONS

A. Environmental Conditions: Comply with ASTM C 840 requirements or respective gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Provide products and systems to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.

B. Design Loads: Provide products and systems to withstand design loads including but not limited to gravity, wind, seismic, and erection design loads established by authorities having jurisdiction, applicable local building codes, and as indicated.

1. Structural Movement: Provide products and systems to withstand movements of structure including, but not limited to, drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads. Contractor shall obtain required design data and identify movements accommodated on submittal drawings.

a. Accommodate plus or minus 3/8 in (10 mm) differential vertical deflection of floors.

C. Dimensional Tolerances: Provide products and systems to accommodate dimensional tolerances of framing members and adjacent construction.

2.4 SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS

A. Suspension System:

1. Material Quality Standard: ASTM C 645, heavy-duty rating.
2. Description: Manufacturer's standard direct-hung suspended grid system composed of main beams and cross furring .members that interlock to form a modular supporting network for application of gypsum board.
3. Protective Coating - Standard Applications: ASTM A 653/A 653M, not less than G40 (Z120), hot-dip galvanized coating, unless otherwise indicated.
4. Main Beams: Inverted T-shaped profile of single or double mounting flange; minimum 1-1/2 in (38 mm) profile height with top bulb and minimum 1-3/8 in (35 mm) wide knurled mounting flange; factory punched for hanger wire, and to receive cross furring members.
5. Cross Furring Members:

    a. Tees: Inverted T-shaped profile of single or double mounting flange; 1-1/2 in (38 mm) profile height with top bulb and minimum 1-3/8 in (35 mm) wide knurled mounting flange; with ends formed for positive interlocking with main beam.
    b. Channels: Inverted hat shaped profile; minimum 7/8 in (21 mm) profile height and minimum 1-3/8 in (35 mm) wide knurled mounting flange; with ends formed for positive interlocking with main beam.

6. Wall Angle: Angle shaped profile with each leg not less than 1-1/4 in (32 mm).
7. Curved Members: Where curved ceilings are indicated, members shall be rolled by manufacturer; field fabricated curved members not permitted.
8. Accessories: Specifically designed as an integral part of suspended grid system.
9. Manufacturers and Products:

    a. Armstrong World Industries Inc.; Drywall Grid System.
    b. Chicago Metallic Corporation; 650-C/670-C Fire-Rated Drywall Grid System.
    c. United States Gypsum Company (USG Interiors, Inc.); Drywall Suspension System.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires 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 a qualified independent testing agency.

    a. Cast-in-place anchor, designed for attachment to concrete.
    b. Post-installed chemical anchor.
    c. Post-installed expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, ANSI A 10.3; low velocity, powder-actuated fasteners; drive pins and clip angles fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
3. Manufacturers:

    a. Construction Materials, Inc.
    b. Heckman Building Products, Inc.
    c. Hilti Corp.
    d. ITW Ramset/Red Head.

e. Powers Fasteners.
f. Simpson Strong Tie Anchor Systems.

4. For post-tensioned concrete, anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.

C. Wire:

1. Material Quality Standard: ASTM A 641 / A 641M, Class 1, zinc-coated, soft annealed, mild steel wire.
2. Tie Wire Minimum Size: Single 0.0625 in (16 gage) (1.6 mm) diameter strand, or double 0.0475 in (18 gage) (1.2 mm) diameter strands. Preformed furring channel clips are acceptable.
3. Hanger Wire Minimum Size: 0.1620 in (8 gage) (4.12 mm) diameter.

D. Rod Hangers: ASTM A 1008 / A 1008M, 7/32 in (0.56 mm) diameter mild carbon steel rod, with primer painted finish.

E. Flat Hangers: ASTM A 1008 / A 1008M, 1 in by 3/16 in (25 mm by 5 mm) by length indicated or required, with primer painted finish.

F. Angle Hangers: ASTM A 36 / A 36M, rolled steel angle, 2 in by 2 in (50 mm by 50 mm), with primer painted finish.

2.5 METAL FRAMING COMPONENTS

A. Project Framing Analysis: Analyze each framing condition for design loads indicated in performance requirements.

1. Provide framing products in sizes and thicknesses required to meet or exceed the criteria based on project loads, spans and in-service conditions.

B. Material Quality Standard: Provide components of sizes indicated but not less than that required to comply with ASTM C 754 for conditions indicated.

1. Sheet Steel: ASTM C 645 for metal.
2. Protective Coating - Standard Applications: ASTM A 653/A 653M, not less than G40 (Z120), hot-dip galvanized coating, unless otherwise indicated.

C. Metal Studs and Floor Track (Runners):

1. Standard Metal Framing Components for Typical Partitions:

a. Stud Description: C-shaped members formed from galvanized sheet steel with 1 1/4 in (32 mm) flange edges bent back 90 degrees and doubled over to form 13/64 in (5 mm) wide minimum return lip; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section; with web punchouts.

1) Alternative Jamb Stud Members - Contractor's Option: "Heavy Duty" or "King" studs; C-shaped members formed from galvanized sheet steel with 3 in (75 mm) flange width; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section.

b. Track (Runner) Description: U-shaped members formed from galvanized sheet steel with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.

1) Floor Track (Runner): 1-1/4in (32 mm).
2) Top of Wall Track (Runner): 3 in (75 mm).

2. Metal Framing for Shaftwall Partitions:

a. Stud Description: C-H, double E, C-T, or I-shaped members formed from galvanized sheet steel; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section; with web punchouts.
b. Track (Runner) and Jamb Description: J-shaped track or jamb members formed from galvanized sheet steel with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.

3. Optional Equivalent Products - Deformed Metal Studs and Tracks (Runners):

a. Evaluation Criteria: Product test reports and certifications from independent testing agency indicating products comply with requirements and are acceptable to authorities having jurisdiction.
b. Material Quality Standard: ASTM A 1003 / A 1003M sheet steel with galvanized coating.
c. Stud Description: C-shaped members formed from deformed surface galvanized sheet steel with 1-1/4 in (32 mm) flange edges bent back 90 degrees and bent again to form 3/16 in (5 mm) wide minimum return lip; of web depth indicated on Drawings and uncoated base metal thickness indicated in "Metal Framing Schedule" at end of this Section; with web punchouts.
d. Track (Runner) Description: U-shaped members formed from deformed surface galvanized sheet steel with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.
e. Manufacturer and Product: ClarkDietrich Building Systems; ProSTUD.

D. Flat Straps and Back-Up Plates: Galvanized sheet steel for blocking and bracing in length and width indicated, of same uncoated base metal thickness as adjacent metal studs.

E. Bridging:

1. Channel: U-shaped members formed from galvanized sheet steel not less than 0.0566 in (16 gage) (1.44 mm) minimum uncoated base metal thickness, with 1/2 in (12 mm) flanges and depth fitting stud punchouts.
2. Clip Angle: 1-1/2 in by 1-1/2 in (38 mm by 38 mm) L-shaped members formed from galvanized sheet steel not less than 0.0713 in (14 gage) (1.81 mm) uncoated base metal thickness.

F. Rigid Furring Channels: Hat-shaped members formed from galvanized sheet steel not less than 0.0312 in (20 gage) (0.78 mm) minimum uncoated base metal thickness; 7/8 in (21 mm) depth and minimum 1-3/8 in (35 mm) wide knurled mounting flange.

G. Framing Accessories for Spanning Multiple Floors: Framing manufacturers standard connectors, bracings, brackets, clips, gussets, and other framing devices as required by conditions, formed from galvanized sheet steel complying with requirements of main support system.

H. Manufacturers:

1. Building Products Division of Consolidated Fabricators Corp.
2. California Expanded Metal Products Co. (CEMCO).
3. ClarkDietrich Building Systems
4. Marino Ware; Division of Ware Industries.
5. MBA Metal Framing.
6. Scafco Corp.

2.6 PRE-ENGINEERED METAL FRAMING COMPONENTS

A. Deflection and Firestop Track (Runner):

1. Description: Proprietary track (runner) formed from galvanized sheet steel manufactured to accommodate movement of building structure without transferring stress to partition (to prevent cracking of gypsum board resulting from deflection of building structure above) 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.
2. Manufacturers:

a. Metal Stud Framing Manufacturer.
b. Fire Trak Corp.
c. The Steel Network.

B. Flexible Track (Runner):

1. Description: Proprietary track (runner) formed from galvanized sheet steel manufactured to be flexible and adjustable to fit design requirements; in thickness not less than indicated for studs and in width to accommodate depth of studs.
2. Manufacturers:

a. Metal Stud Framing Manufacturer.
b. Accu-Arc Curved Wall Products.
c. Flex-Ability Concepts.
d. Radius Track Corp.

C. Headers:

1. Description: Proprietary header assembly formed from galvanized sheet steel manufactured to bear partition load above openings without transferring stress to partition (to prevent cracking of gypsum board); in thickness not less than indicated for studs and in width to accommodate depth of studs.
2. Manufacturers:

a. Metal Stud Framing Manufacturer.
b. Brady Construction Innovations, Inc.

2.7 GYPSUM BOARD PRODUCTS

A. Sizes: Maximum lengths and widths available that will minimize short edge-to-short edge butt joints and to correspond to support system indicated.

B. Typical Paper-Faced Gypsum Board Products:

1. Paper-Faced Type X Gypsum Board:

a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
b. Description: Noncombustible fire resistant gypsum core with paper surfacing on face, back, and long edges; tapered long edges; 5/8 in (15 mm) thick.
c. Manufacturers and Products:

1) American Gypsum Company; FireBloc Type X Gypsum Board.
2) CertainTeed Corporation; Type X Gypsum Board.
3) Georgia-Pacific Gypsum LLC; ToughRock Fireguard Gypsum Board.
4) National Gypsum Company; Gold Bond Fire-Shield Gypsum board.
5) United States Gypsum Company (USG); Sheetrock Firecode Core.

2. Sustainable Paper-Faced Type X Gypsum Board: Preferred option, provide sustainable paper-faced Type X gypsum board or typical paper-faced Type X gypsum board.

a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
b. Description: Noncombustible fire resistant gypsum core with paper surfacing on face, back, and long edges; tapered long edges; 5/8 in (15 mm) thick. UL Type Designation ULIX.

1) ISO 14040 Environmental Management, Life Cycle Assessment, Principles and Framework:

a) Carbon emissions per Gypsum Association; Industry Standard Type III EPD for North American Type X wallboard with a manufacturing Global Warming Potential of 317.4 kg CO2-eq./1000MSF.
b) Water reduction per Gypsum Association; Industry Standard Type III EPD for North American Type X wallboard having net use of fresh water value of 1.329 m3/1000 ft2.
c) Primary Energy from non-renewable resources per Gypsum Association; Industry Standard Type III EPD for North American Type X wallboard have a value of 5,291 MJ/1000 ft2.

c. Basis of Design:

1) United States Gypsum Company, LLC, USG Sheetrock Brand EcoSmart Panels Firecode X.

3. Paper-Faced Flexible Gypsum Board at Curved Surfaces:

a. Material Quality Standard: ASTM C 1396 / C 1396M.

b. Description: Gypsum core with paper surfacing on face, back and long edges; manufactured to bend to fit tight radii and be more flexible than typical panels without wetting; tapered long edges; 1/4 in (6 mm) thick.
c. Manufacturers and Products:

1) American Gypsum Company; 1/4 ClasicRoc Gypsum Board.
2) CertainTeed Corporation; 1/4"□ Flex Gypsum Board.
3) Georgia-Pacific Gypsum LLC; ToughRock FlexRoc Gypsum Board.
4) National Gypsum Company; Gold Bond High Flex Brand Gypsum board.
5) United States Gypsum Company (USG); Sheetrock 1/4"□□ Flexible Gypsum Panels.

C. Moisture-Resistant Gypsum Board Products:

1. Moisture-Resistant Paper-Faced Gypsum Board:

a. Material Quality Standard: ASTM C 1396 / C 1396M, Type X.
b. Description: Enhanced moisture-resistant, noncombustible gypsum core, with moisture-resistant paper surfacing on face, back and long edges; tapered long edges; score of 10 according to ASTM D 3273; 5/8 in (15 mm) thick.
c. Manufacturers and Products:

1) American Gypsum Company; M-Bloc Mold and Moisture Resistant Type X Gypsum Board.
2) CertainTeed Corporation; M2Tech Moisture and Mold Resistant Type X Gypsum Board.
3) National Gypsum Company; Gold Bond XP Gypsum Board.
4) United States Gypsum Company (USG); Sheetrock Mold Tough Firecode Gypsum Board.

2. Moisture-Resistant Paperless Glass-Mat Gypsum Board:

a. Material Quality Standard: ASTM C 1658 / C 1658M.
b. Description: Enhanced moisture-resistant, noncombustible gypsum core with inorganic, embedded fiberglass mat on both faces; square edges; score or 10 according to ASTM D 3273; 5/8 in (15 mm) thick.
c. Manufacturers and Products:

1) Georgia-Pacific Gypsum LLC; DensArmor Plus Fireguard Interior Guard.
2) National Gypsum Company; eXP Interior Extreme Gypsum Panels.

3. Moisture-Resistant Paperless Glass-Mat Shaft-Liner Gypsum Board:

a. Material Quality Standard: ASTM C 1396 / C 1396M.
b. Description: Enhanced moisture-resistant, noncombustible gypsum core with inorganic, embedded fiberglass mat on both faces, double bevel long edges; score of 10 according to ASTM D 3273; 1 in (25 mm) thick.
c. Manufacturers and Products:

1) American Gypsum Company; M-Glass Shaft Liner Panels.
2) CertainTeed Corporaton; GlasRoc Shaftliner Type X.
3) Georgia-Pacific Gypsum LLC; DensGlass Shaftliner.
4) National Gypsum Company; eXP Extended Exposure Shaftliner.

5) USG Corp.; SHEETROCK Glass-Mat Liner Panels

4. Moisture-Resistant Coated Glass-Mat Gypsum Board Products:

a. Material Quality Standard: ASTM C 1178 / C 1178M.
b. Description: Enhanced moisture-resistant, noncombustible, gypsum core with inorganic, embedded fiberglass mat on both sides; outside face coated with heat-cured copolymer water-resistant coating; square edges; score or 10 according to ASTM D 3273; 5/8 in (15 mm) thick.
c. Manufacturers and Products:

1) CertainTeed Corporation; Diamondback Tile Backer.
2) Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
3) National Gypsum Company; eXP Tile Backer.

2.8 TRIM ACCESSORIES

A. Typical Drywall Trim Accessories:

1. Material Quality Standard: ASTM C 1047.
2. Description: Trim profile fabricated of galvanized steel sheet; of size suitable for gypsum board thickness; with recessed, perforated flange formed to receive joint compound.
3. Trim Products:

a. Cornerbead:

1) Purpose: For protecting outside (external) corners.
2) Basis of Design: United States Gypsum Company (USG); Dur-A-Bead Corner Bead, 103.

b. Optional Equivalent Products – Structural Laminate Cornerbead System: At Contractor's option, provide high strength tapered co-polymer core cornerbead with tight fibered paperboard facing and joint tape paper backing.

1) Purpose: For protecting outside (external) corners.
2) Basis of Design: Structus Building Technologies; No-Coat Structural Laminate Drywall Corner System.

c. LC-Bead (J-Bead):

1) Purpose: For protecting exposed edges of gypsum board where back flange can be used.
2) Basis of Design: United States Gypsum Company (USG); J-Trim, 200-A.

d. L-Bead:

1) Purpose: For protecting exposed edges of gypsum board where back flange cannot be used.
2) Basis of Design: United States Gypsum Company (USG); L-Trim, 200-B.

e. J-Stop:

1) Purpose: For protecting edges of gypsum board that does not require finishing.
2) Basis of Design: United States Gypsum Company (USG); J-Stop, 402.

f. Control Joint:

1) Description: One-piece trim formed with V-shaped slot, with removable strip covering slot opening.
2) Purpose: For conditions requiring expansion and contraction stresses of large areas of gypsum board to be relieved.
3) Basis of Design: United States Gypsum Company (USG); Control Joint, 093.

g. Other Trim or Special Shapes: Products as required by condition.

4. Manufacturers:

a. Dietrich Industries, Inc.; Unimast.
b. Fry Reglet Architectural Metals.
c. Marino Ware; Division of Ware Industries.
d. Niles Building Products Co.
e. Superior Metal Trim; Division of Delta Star, Inc.
f. United States Gypsum Company (USG).

B. Plastic Drywall Trim Accessories:

1. Description: Trim profile fabricated of high-impact PVC, of size suitable for gypsum board thickness; with recessed, perforated flange formed to receive joint compound.
2. Trim Products Profiles: As listed above in "Typical Drywall Trim Accessories".
3. Manufacturers:

a. Alabama Metal Industries Corporation; a Gibraltar Industries Company.
b. Phillips Manufacturing Co.
c. Plastic Components, Inc.
d. Trim Tex Drywall Products.
e. Vinyl Corp., a division of ClarkDietrich Building Systems.

C. Accent Trim Accessories:

1. Description: Extruded aluminum accessories of profiles and dimensions indicated of alloy and temper with not less than strength and durability properties of ASTM B 221, alloy 6063-T5.

2. Manufacturers:

a. Fry Reglet Architectural Metals.
b. Gordon, Inc.
c. Pittcon Industries.

D. Wall to Aluminum Window Trim Accessories (Perpendicular to Exterior Windows):

1. Sound Barrier Partition/Mullion Trim Cap:

a. Description: Custom fabricated extruded two-piece aluminum sections of profile indicated on Drawings. Fabricate to engage end of partition and cover mullion. Alloy and temper with not less than strength and durability properties of ASTM B 221, alloy 6063-T5; width as required by condition. Insulate as indicated, seal to glass with compressible foam closure.

1) Finish: As selected by Architect to match mullion finish.

2.9 FASTENERS

A. Limitations: Nails and staples are not permitted.

B. Fasteners for Attaching Metal Framing to Concrete Structure:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires 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 a qualified independent testing agency.

a. Cast-in-place anchor, designed for attachment to concrete.
b. Post-installed chemical anchor.
c. Post-installed expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, ANSI A 10.3; low velocity, powder-actuated fasteners; drive pins and clip angles fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
3. Manufacturers:

a. Construction Materials, Inc.
b. Heckman Building Products, Inc.
c. Hilti Corp.
d. ITW Ramset/Red Head.
e. Powers Fasteners.
f. Simpson Strong Tie Anchor Systems.

4. For post-tensioned concrete, anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.

C. Metal Framing Screws: Screw fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten metal framing and furring members securely to substrates involved; complying with recommendations of gypsum board manufacturers for applications indicated.

D. Gypsum Board Screws:

1. Material Quality Standards:

a. Metal Framing Members less than 0.03 in (0.75 mm) Thick: ASTM C 1002, Type S.

b. Metal Framing Members from 0.033 in to 0.112 in (0.79 mm to 2.9 mm) Thick: ASTM C 954, Type S-12.

2. Product Description - Standard Applications: Bugle head, self-drilling, self-tapping, steel screws with Phillips-head recess of size, holding power, and other properties recommended by respective gypsum board manufacturer; minimum 1 in (25 mm) long; with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

E. Miscellaneous Fasteners: For conditions not indicated, fasteners shall be type, finish, size, and holding power recommended by respective gypsum board manufacturer and conditions.

2.10 JOINT TREATMENT MATERIALS

A. Material Quality Standard: ASTM C 475 / C 475M.

B. Joint Tape:

1. Paper Tape: Nominal 2 in (50 mm) wide cross-fibered paper tape with finish suitable for bonding, creased in center for easy folding, and compatible with joint compound.
2. Mesh Tape: Nominal 2 in (50 mm) wide self-adhering 10-by-10 fiberglass mesh tape.

C. Joint Compound:

1. Setting-Type: Job-mixed powder for mixing with water, chemical-hardening compound; includes taping types.
2. Drying-Type: Ready-mixed or job-mixed powder for mixing with water, air-drying, vinyl based compounds; includes taping, topping, and all-purpose types.

2.11 INTERIOR SURFACING COMPOUNDS

A. Level 5 Primer and Surfacer: Latex based compound containing polyvinyl acetate (PVA) polymer that can be spray or roller applied to change a Level 4 finish to a Level 5 finish.

1. Manufacturers and Products:

a. CertainTeed Corporation; ProRoc Level V Wall and Ceiling Primer/Surfacer.
b. United States Gypsum Company (USG); Sheetrock Brand Tuff-Hide Primer-Surfacer.

B. Concrete Surfacing Compound: Vinyl-based, factory-formulated product applied in two or more coats as necessary for filling and smoothing to provide monolithic concrete surfaces to match Gypsum Board Level 4 finish.

1. Basis of Design: United States Gypsum Company (USG); Cover Coat Brand Compound.

2.12 RELATED MATERIALS

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced quality standards and recommendations of gypsum board manufacturer.

B. Firestopping Products at Penetrations: As specified in Division 07 Section "Penetration Firestopping".

C. Fiberglass Sound Attenuation Blankets:

1. Material Quality Standard: ASTM C 665, Type I.
2. Description: Unfaced blankets produced by bonding inorganic glass fibers with a thermosetting binder; free of formaldehyde.
3. Surface Burning Characteristics: According to ASTM E 84/NFPA 255/UL 723:

   a. Flame Spread: Class A - no greater than 25.
   b. Smoke Developed: No greater than 50.

4. Thickness: Not less than 2-1/2 in (62 mm), unless otherwise indicated.
5. Basis of Design: Johns Manville; Sound Control Batts, Formaldehyde Free.

D. Mineral Wool Sound Attenuation Blankets:

1. Material Quality Standard: ASTM C 665, Type I.
2. Description: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of rock or slag with thermosetting resins.
3. Surface Burning Characteristics: According to ASTM E 84/NFPA 255/UL 723:

   a. Flame Spread: Class A - no greater than 25.
   b. Smoke Developed: No greater than 50.

4. Thickness: Not less than 3 in (75 mm), unless otherwise indicated.
5. Density: Not less than nominal 2.5 pounds per cubic foot.
6. Manufacturers:

   a. Fibrex Insulations, Inc.
   b. Rock Wool Manufacturing Co.
   c. Roxul.
   d. Thermafiber LLC.

E. Thermal Insulation:

1. Unfaced: ASTM C 612, Types IA and IB. Unfaced rock mineral wool board insulation.

   a. Location: Typical unless noted to be foil-faced.

2. Foil-Faced: ASTM C 612, Types IA and IB. Rock mineral wool board insulation faced with foil-scrim-kraft vapor-retarder membrane.

   a. Location: Where indicated on drawings for non-fire-rated perimeter conditions and/or for spandrel insulation.

3. Density: Nominal density of 4 lb/cu. ft. (64 kg/cu. m), thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).
4. Surface Burning Characteristics per ASTM E 84:

   a. Flame spread: 25 or less.

b. Smoke developed: 50 or less.

5. Thickness: As indicated on drawings but not less than required for an R-value of 19.
6. Fiber Color: Regular color, unless otherwise indicated.
7. Manufacturers:

a. Johns Manville.
b. Rockwool.
c. Themafiber, Inc.

F. Acoustical Sealant for Non-Fire Resistance Rated Joints:

1. Description: Manufacturer's standard nonsag, paintable, nonstaining sealant complying with ASTM C 834 or ASTM C 920. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90 or other acceptable test method.

a. Preconstruction Compatibility Testing: Test sealant for compatibility with copper substrates. Testing will not be required if data submitted on previous testing of current sealant products matches those submitted.
b. Do not use acrylic, neoprene, and nitrile based sealants that are not recommended for use with copper substrates.

G. Fire-Resistance Rated and Acoustical Putty Pads:

1. Product Quality Standard: UL 263 (ASTM E 119).
2. Description: Fire-rated, non-hardening, moldable, intumescent compound formed into sheets designed to seal penetrations, construction gaps, and around electrical boxes against spread of fire, smoke, and toxic gases.
3. Manufacturers and Products:

a. Grace Construction Products; Flamesafe FSP 1077 Putty Pads.
b. Hilti; CP 617 Intumescent Acoustic Putty Pads.
c. Hilti; CFS-P PA.
d. Specified Technologies, Inc; Series SSP Putty Pads.
e. Tremco; TREMstop Electrical Box Insert.
f. 3M; Fire Barrier Moldable Putty+Pads.

H. Fire Resistive Sealants: Intumescent elastomeric sealant as specified in Division 07 Section "Fire-Resistive Joint Firestopping".

I. Sealants: Sealant as specified in Division 07 Section "Joint Sealants".

J. Isolation Strips: Adhesive-backed, closed cell neoprene or vinyl foam strips that allow fastener penetration with foam displacement, size as indicated, compressed 50 percent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective Manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.
4. Gypsum Association GA 216.
5. United States Gypsum Company (USG); Gypsum Construction Handbook, if no other installation quality standard applies to condition.

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

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Suspended Gypsum Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hanger wires at spacing required to support ceilings and that hangers will develop their full strength.

3.4 INSTALLATION OF GYPSUM BOARD ASSEMBLIES

A. Comply with ASTM C 840.

B. Resistance Rated Partitions: Construct fire resistance rated, smoke resistance rated, and sound resistance rated partitions according to respective assembly test reports. Ensure every material used within an assembly shall comply with manufacturers listed and product qualities indicated in respective assembly test report.

C. Penetrations and Openings: Construct within gypsum board assemblies work as required to properly form penetration or opening to receive firestopping materials specified in following Sections:

1. Division 07 Section "Penetration Firestopping".
2. Division 07 Section "Fire-Resistive Joint Firestopping".

D. Control Joints: Install control joints at locations indicated on Drawings, in specific locations approved by Architect for visual effect and according to the following:

1. Spaced not more than 24 to 30 feet in either direction for uninterrupted straight planes of ceilings and walls.
2. Where different substrates occur at ceilings and walls.
3. Where control joints occur in substrates at ceilings and walls.
4. Where L, U, or T shaped ceiling configurations are joined.
5. At less-than-ceiling-height cased opening frames and gypsum board openings over 60 inches in width; extend control joints from both corners at top of frame or opening up to ceiling.
6. Where less-than-ceiling-height door frames occur on walls more than 30 feet in length; extend control joints from top of frame up to ceiling at corner of hinge side of door
7. Where less-than-ceiling-height borrowed lites occur on walls more than 30 feet in length; extend control joints from top of frame up to ceiling and from bottom of frame to floor at both corners.

E. Isolation from Building Structure: Isolate gypsum board assemblies from building structure to prevent transfer of loading imposed by structural movement.

1. Provide isolation joints as indicated or required by installation quality standards.
2. Isolate ceiling assemblies abutting or penetrated by building structure.
3. Isolate partition framing and wall furring abutting or penetrated by building structure, except at floor.

F. Building Expansion Joints: Avoid bridging building expansion joints with metal framing or furring members; frame both sides of joints independently with framing or furring members, coordinating with building expansion joint products specified in Division 07 Section "Expansion Control".

G. Fire-Resistance Rated and Acoustical Putty Pads: Hand apply pads to surfaces indicated, packing tightly into gaps and openings, in such a manner that pad will remain secured to surface; pinch pleat excess material together to close gaps.

H. Supplemental Accessories: Install supplementary framing, blocking, reinforcing, and bracing in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, hand rails, furnishings, or similar construction. Comply with details indicated and recommendations of installation quality standards or manufacturer.

## 3.5 INSTALLING SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS

A. Installation Quality Standard: In addition to standards listed elsewhere, perform suspended ceiling work according to following, unless otherwise specified in this Section:

1. ASTM C 636 / C 636M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

B. Pattern: Lay out spaces and arrange suspension system in a regular pattern, parallel or perpendicular to surrounding walls.

C. Hangers for Ceiling System: Suspend hangers from building structural members and as follows:

1. Install hangers plumb and free from contact with mechanical and electrical equipment, insulation or other objects within ceiling plenum that are not part of supporting structural frame or ceiling suspension system. Within limitations allowed by installation quality standards, 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 location of hangers required to support suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by installation quality standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure the appropriate hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, 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. Install metal framing components for suspended ceilings so that members are level to within 1/8 in in 12 ft (3 mm in 3.6 m) as measured both lengthwise on each member and transversely between parallel members.
6. Attach hangers to structural members.
7. Do not connect or suspend any ceiling components from ducts, pipes or conduit.

D. Perimeters: Using gypsum board screws through gypsum board into metal studs, attach perimeter wall angle where suspended grid system meets vertical surfaces unless otherwise indicated; cut main beams and cross furring members to fit into wall angle.

E. Main Beams:

1. Suspend main beams spaced 48 in (1200 mm) on center from structure with wire hangers spaced not greater than 48 in (1200 mm) on center.
2. Install main beams level within 1/8 in in 12 ft (3 mm in 3.6 m) with hanger wire taut and tightly wrapped to prevent vertical movement or rotation.
3. Do not make local kinks or bends in hanger wires as a means of leveling.

F. Cross Furring Members:

1. Install cross furring members at right angles to main beams, spaced as required and join to main beams with positive interlock.
2. Install cross furring members to within 1/32 in (0.8 mm) of their required location and within 0.015 in (0.38 mm) of same horizontal plane as main beam, and never below continuous member.
3. Install additional cross furring members at right angles to beams and cross furring members to support ends of recessed light fixtures, diffusers or grilles.

## 3.6 INSTALLING METAL FRAMING COMPONENTS

A. Priority: Assemble various assemblies giving priority to partitions with higher rating; extend partition with higher rating intact through partition with lower rating.

B. Joinery and Connections: Install various metal framing components according to details indicated; for situations and conditions not indicated, comply with installation quality standards and with respective manufacturer's recommendations.

C. General Requirements: Construct partition framing of studs, tracks, and headers using screws of number and spacing required.

1. Install studs of uncoated base metal thickness as determined by Metal Framing Schedule at end of this Section.
2. Extend partition framing full height to underside of structure above, except where partitions are indicated to terminate at, or immediately above, suspended ceilings.
3. Continue framing over door frames and openings to provide support for gypsum board.
4. Space studs as indicated on Metal Framing Schedule at end of this section.
5. Cut studs 1 in (25 mm) short of full height to provide deflection relief at head of wall conditions.
6. Install studs so that flanges point in same direction.
7. Attach with screws through each stud flange and track (runner) flange, except top deflection track assemblies.
8. For fire resistance rated, smoke resistance rated, and sound resistance rated assemblies that are required to extend to underside of structure above to obtain ratings, install framing around structural and other members extending below floor slabs or roof decks, as needed to support gypsum board closures and make partitions continuous from floor to underside of structure above.
9. Do not lap studs.
10. At intersections and corners, locate studs no more than 2 in (50 mm) from partition intersections and corners and secure with screws through both flanges of studs and tracks.

D. Metal Track (Runner) Requirements:

1. Floors: Install tracks (runners) using appropriate fasteners spaced not more than 16 in (400 mm) on centers.
2. Head of Wall: Install deep leg deflection tracks using appropriate fasteners to laterally support assembly, and to avoid axial loading of assembly by deflection from building structure above.
3. Head of Wall: Where indicated, install proprietary deflection and firestop track (runner) using appropriate fasteners for the substrate and installation conditions.

E. Support for Wall Mounted Accessories or Equipment: Install back-up plate or track (runner) turned on its side, using screws as indicated or as required, to studs to properly transfer accessory or equipment load to metal framing.

F. Openings: Frame single door, double door, above ceiling openings, and below ceiling openings using studs, tracks (runners), clip angles, and headers.

1. Install 2 studs on each side of each opening in configuration indicated, including strap plates; extend from floor to underside of structure above; do not cut these studs under any circumstances. Include sound attenuation blankets within cavity when partition is scheduled to have a sound resistance rating.
2. Construct header of appropriate configuration for type of opening to be spanned and secure with clip angles; include sound attenuation blankets within cavity when partition is scheduled to have a sound resistance rating.
3. Install short intermediate studs 16 in (400 mm) on center between top track and header.
4. At partitions indicated to terminate immediately above ceiling, install diagonal bracing at not less than spacing as indicated.

G. Supplementary Framing: Install around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by metal framing.

H. Penetrations: Maintain fire-resistance rating of assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

I. Chase Partitions:

1. Position double row of studs vertically in tracks (runners), opposite each other in pairs with flanges pointing in same direction.
2. Attach with screws through each stud flange and track (runner) flange.
3. Cross brace between rows of studs with one of following at 48 in (1200 mm) on center maximum vertically, attached to stud webs with screws:

   a. Coated glass-mat gypsum board, 12 in (300 mm) high by chase width.
   b. Metal studs turned on side, webs back-to-back.

J. Furred Walls:

1. Erect furring channels vertically, spaced 16 in (400 mm) on centers maximum, unless otherwise indicated.
2. Attach with appropriate fasteners, staggered on flanges.
3. Splice ends by nesting channels 8 in (200 mm) and securely anchoring to surface.
4. Miter 24 in (600 mm) long horizontal furring channels at corners and space 24 in (600 mm) on centers vertically.
5. Locate furring channels around perimeter of openings and secure to surfaces.

K. Control Joints:

1. Construct metal framing as indicated by installation quality standard to allow gypsum board control joints to function as intended.
2. For control joints located in fire resistance rated walls and partitions, construct of metal studs and mineral wool, full height of partition, according to assembly fire test reports.

L. Metal Framing Spanning Multiple Floors: Construct metal framing as required using longest length metal studs possible and attach to building structure with floor bypass clips.

M. Curved Partitions:

1. Metal Track (Runner) shall comply with one of following:

   a. Field Fabricated From Straight Components:

      1) Cut top and bottom runners (tracks) through leg and web at 2 in (50 mm) intervals for arc length. In cutting lengths of runners allow for uncut straight lengths of not less than 12 in (300 mm) at ends of arcs.
      2) Bend runners to uniform curve of radius indicated and locate straight lengths so they are tangent to arcs.
      3) Support outside (cut) leg of runners by clinching a 1 in (25 mm) high by runner thickness sheet metal strip to inside of cut legs using metal lock fasteners.

b. Field crimped using a crimping tool.
c. Manufactured flexible products.

2. For full height partitions, attach runners to structural elements at floor and ceiling with appropriate fasteners located 2 in (50 mm) from ends and spaced 12 in (300 mm) on centers.
3. For ceiling height partitions, attach runners to suspended ceilings with toggle bolts or hollow wall anchors located 2 in (50 mm) from ends and spaced 8 in (200 mm) on centers in between where attached to suspended ceilings.
4. Position studs vertically with open sides facing in same direction and engaging floor and ceiling runners.
5. Begin and end each arc with a stud and space intermediate studs equally along arcs at stud spacing recommended by gypsum board manufacturer for radii indicated.
6. Attach studs to runners with 3/8 in (10 mm) long pan head framing screws. On straight lengths at ends of arcs, place studs 6 in (150 mm) on centers with last stud left free standing.

N. Installation Tolerances: Install each metal stud metal framing and furring member so that fastening surfaces do not vary more than 1/8 in (3 mm) from plane formed by faces of framing members.

3.7 INSTALLING GYPSUM BOARD PRODUCTS

A. General Requirements:

1. Install type of gypsum board at location indicated by gypsum board schedule at end of this Section.
2. Do not install damaged gypsum boards.
3. Install gypsum boards with finishable face side out.
4. Butt gypsum boards together for a light contact at edges and ends with not more than 1/16 in (1.5 mm) of open space between panels.
5. Do not force gypsum boards into place.
6. Do not place tapered edges against cut edges or ends.
7. Locate panel joints so that no joint will align with the edge of an opening unless control joints are installed at these locations.

B. Isolation from Building Structure:

1. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments or surfaces where movement is anticipated. Provide 1/4 in to 1/2 in (6 mm in 12 mm) wide spaces at these locations or as indicated below:

a. At top of wall or where partitions intersect open building structure members projecting below underside of floor slabs and roof decks, cut to fit profile formed by coffers, joists, beams, and other structural members; form proper annular joint to receive firestopping at rated partitions and form 3/4 in (20 mm) joint at top of wall at non-rated partitions.

2. Trim edges with edge trim where edges of gypsum boards are exposed.
3. Seal joints between edges and abutting structural surfaces with firestopping at rated locations and acoustical sealant at non-rated locations.

C. Single-Layer Board Assemblies:

1. At typical conditions, install gypsum board vertically (long dimension parallel to metal framing), to minimize short end-to-short end joints unless otherwise indicated or required by assembly fire test reports.
2. At interior of stairwells and other high walls, install gypsum boards horizontally, unless otherwise indicated or required by assembly fire test reports. Stagger abutting end joints not less than one framing member in alternate courses of gypsum boards.

D. Multi-Layer Board Assemblies: Apply base layers and face layers vertically (long dimension parallel to metal framing) with joints of base layers located over stud or furring member and face layer joints offset at least one stud space from base layer joints, unless otherwise indicated or required by assembly fire test reports. Stagger joints on opposite sides of partitions.

E. Ceiling Applications:

1. Apply gypsum board at right angles to main beams of suspension framing to minimize number of abutting end joints and avoid abutting end joints in central area of each ceiling.
2. Stagger abutting end joints of adjacent panels not less than one framing member.
3. Locate both edge or end joints of gypsum boards over intermediate supports or gypsum board back-blocking where metal framing is not present.

F. Typical Wall Applications:

1. Attach gypsum boards to metal studs so that leading edge or end of each board is attached to open (unsupported) edges of stud flanges first.
2. Stagger vertical joints on opposite sides of partitions.
3. Do not make joints other than control joints at corners of framed openings.
4. Attach gypsum boards to framing provided at doors, openings and cutouts. Install gypsum boards over door heads and extend to not less than one stud space - 16 in (400 mm) at each side of door or opening.
5. Cover both faces of metal framing with gypsum boards as indicated, except in chase walls that are braced internally.
6. Cut and fit gypsum boards around ducts, pipes, conduits, and other penetrations to form proper annular joint to receive firestopping at rated partitions.

    a. At non-rated partitions, annual space around ducts, pipes, conduit or other penetrations to be properly sized to receive sealant; 3/4 in (20 mm) maximum.
    b. "Blow–out" patches are not allowed.

7. Support both edge and end joints of gypsum boards over metal framing.

G. Curved Wall Assemblies:

1. Install 2 layers of flexible gypsum board horizontally and unbroken, to extent possible, across curved surface plus 12 in (300 mm) long straight sections at ends of curves and tangent to them.
2. On convex sides of partitions, begin installation at one end of curved surface and fasten gypsum boards to studs as they are wrapped around curve. On concave side, start fastening gypsum boards to stud at center of curve and work outward to panel ends.
3. Fasten base layer to studs with screws spaced 16 in (400 mm) on centers maximum. Center second layer over joints in base layer, and fasten to studs with screws spaced 12 in (300 mm) on centers maximum.

H. Screw Attachments:

1. Attach gypsum board to metal framing with screw fasteners of type appropriate for gypsum board materials and installation conditions:

   a. Length shall be as required by condition and penetrating metal framing not less than 3/8 in (10 mm).
   b. Spacing shall be as recommended by installation quality standard, gypsum board manufacturer, or respective assembly test report.
   c. Use properly adjusted, positive-clutch electric power tool equipped with adjustable screw-depth head and a Phillips bit. Nails and staples are not permitted.

2. Drive screws to slightly dimple surface without breaking face paper, fracturing core, or stripping metal framing member around screw shank.
3. Space screws for non-fire resistance rated partitions and ceilings as recommended by installation quality standards.
4. Space screws for fire resistance rated partitions as required by assembly fire test reports.
5. Start field screwing near center and work towards edges.
6. Space screws not less than 3/8 in (10 mm) from gypsum boards edges.
7. Do not attach gypsum boards to top runner where wall or partition extends to building structure unless required by fire test reports.

I. Control Joints: Form control joints and expansion joints at locations indicated with required space between edges of adjoining gypsum boards.

J. Sound Attenuation Blankets: Install blankets within stud cavities set so that they are held in place by friction with metal studs; ensure blankets are secure within cavity and will not become displaced when second gypsum board side is closed.

K. Mineral Wool Semi-Rigid Insulation: Install in cavities formed by framing members according to the following requirements:

1. Glazed Aluminum Framing System (Curtainwall) Installations:

   a. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
   b. Install insulation to fit snugly without bowing.
   c. Install mullion covers, minimum 8 in (200 mm) width of insulation, centered over horizontal and vertical aluminum frames within spandrel area using the same impaling pins as used to attach the curtainwall insulation material. Secure covers with clinch shields over impaling pins.

L. Sealant:

1. Comply with ASTM C 919 and manufacturers written recommendations for closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
2. Seal wall assemblies at perimeters, behind control joints, and at openings and penetrations with a continuous bead of sealant material according to following:

a. Fire Resistance Sealant: Joints within fire resistance rated assemblies.
b. Water Resistance Sealant: Joints within non-fire resistance rated assemblies exposed to possible water infiltration.
c. Acoustical Sealant: All other joints.

3.8 INSTALLING TRIM ACCESSORIES

A. General: Fasten trim accessories continuously according to accessory manufacturer's instructions using gypsum board screws; installation by clinch-on tool and staples not permitted.

B. Interior Trim Accessories: Install in the following locations:

1. Corner Beads: Install trim at external corners; use screws at each flange at 9 in (225 mm) on centers, opposite each other.
2. Edge Trim: Install trim where gypsum boards abut dissimilar material, and where edge of gypsum boards would otherwise be exposed; use screws at flange at 9 in (225 mm) on centers.

a. LC-Bead (J-Bead): Install trim at exposed conditions where back flange can be attached to framing or supporting substrate before gypsum board installation.
b. L-Bead: Install trim at exposed conditions where trim can only be installed after gypsum board installation.
c. J-Stop: Install trim at concealed conditions where trim can only be installed after gypsum board installation.

3. Control Joints: Install trim at appropriate locations, ensuring gypsum board is not continuous over joint; use screws at each flange at 6 in (150 mm) on centers.

a. Control joints to extend 4 in (100 mm) above finished ceiling at non-rated conditions and extend to structure at rated wall conditions.

C. Accent Trim Accessories: Install at locations indicated, mitering corners and intersections to form tight, flush and uniform joints; use screws at each flange at 9 in (225 mm) on centers.

D. Trim Accessories at Exterior Windows: Install at locations indicated, mitering corners and intersections to form tight, flush and uniform joints; use screws at each flange at 9 in (225 mm) on centers or as recommended by manufacturer for manufactured products.

3.9 FINISHING GYPSUM BOARD PRODUCTS

A. General: Treat board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare surfaces for decoration.

B. Joint Tape: Finish joints according to following:

1. Typical Paper-Faced Gypsum Board: Paper.
2. Moisture-Resistant Paper-Faced Gypsum Board: Mesh tape.

C. Finishing: Finish boards and units to achieve specified level of finish as indicated in schedule at end of Section:

1. Typical Paper-Faced Gypsum Board: Either or combination of the following as recommended by manufacturer:

    a. Setting-type joint compounds.
    b. Drying-type joint compounds.

2. Moisture-Resistant Paper-Faced Gypsum Board: Setting-type joint compounds.

3.10 INTERIOR SURFACING COMPOUNDS

A. Skim Coat Finishing with Joint Compound:

1. Prepare concrete surfaces for applied finishes.

    a. Grind ridges, fins, and high areas.
    b. Remove form oil, efflorescence and greasy deposits.
    c. Fill offsets, voids, bugholes, rock pockets level with surrounding surfaces with joint compound.
    d. Apply as many coats of joint compound as necessary to eliminate cracks.
    e. Verify that resulting concrete surface is uniformly smooth and free of irregularities.

2. Apply setting-type joint compound or Level 5 Primer and Surfacer over entire surface in thickness recommended by manufacturer.

B. Skim Coat Finishing with Concrete Surfacing Compound:

1. Prepare concrete surfaces for applied finishes.

    a. Grind ridges, fins, and high areas.
    b. Remove form oil, efflorescence and greasy deposits.
    c. Fill offsets, voids, bugholes, rock pockets level with surrounding surfaces with concrete surfacing compound.
    d. Apply as many coats of concrete surfacing compound as necessary to eliminate cracks.
    e. Verify that resulting concrete surface is uniformly smooth and free of irregularities.

2. Apply Concrete Surfacing Compound over entire surface in thickness recommended by manufacturer.

3.11 ADJUSTMENTS

A. Damaged Materials: Stored or installed gypsum board materials shall be classified as damaged, defective, and nonconforming Work if they have been exposed to wetness or dampness at any time prior to Substantial Completion or if they exhibit evidence of active or dormant mold or mildew. Damaged materials and assemblies shall be replaced with new and dry materials and assemblies.

3.12 PROTECTION

A. Procedures: Protect products and systems from damage during installation and remainder of construction period according to manufacturer's instructions.

3.13 METAL FRAMING SCHEDULE

A. Metal Stud Framing Schedule:

1. Stud Depth: As indicated on Drawings.
2. Spacing: Maximum 16 in (400 mm) on centers, unless otherwise indicated, or as required to comply with respective assembly test report.
3. Minimum Performance Requirements: Lateral pressure loads (lb/sq ft) are allowable design values and shall not be reduced further by load combinations. Minimum performance requirements unless otherwise indicated:

   a. Typical Partitions: L/240 at 5 lb/sq ft (239 Pa) lateral load.
   b. Partitions with Tile Facing: L/360 at 7.5 lb/sq ft (359 Pa) lateral load.
   c. Partitions supporting all other Concentrated Loads: Provide delegated engineering to comply with L/360 at 10 lb/sq ft (479 Pa) lateral load

4. Minimum Uncoated Base Metal Thickness:

   a. Typical Gypsum Board Assemblies: As determined by manufacturer's limiting height engineering data unless otherwise indicated.

      1) 22 Gage Studs: Typical partitions unless otherwise indicated.
      2) 20 Gage or 20 Gage Equivalent Studs:

         a) Partitions supporting ceramic or stone tile.
         b) Partitions with gypsum board on one side only.
         c) At door jambs.
         d) Partitions supporting wall hung cabinets or shelving.

      3) 20 Gage Equivalent Studs: Allowed only if part of a tested assembly.

   b. Gypsum Board Assemblies required to Support Concentrated Loads: As required by delegated engineering professional but not less than minimum uncoated base metal thickness indicated above.

3.14 GYPSUM BOARD SCHEDULE

A. Gypsum Board Schedule, General: Install the designated gypsum board product based on exposure classification to water and / or moisture and applied finish system as follows, unless otherwise indicated or scheduled on the Drawings.

B. No Exposure: Surfaces not normally exposed to water and / or moisture sources including but not limited to the following:

1. Typical walls and ceilings.

   a. Paint and Wall Coverings Only: Typical paper-faced gypsum board.
   b. Tile: Moisture-resistant coated-glass-mat gypsum board.

2. Curved walls:

a. Paint and Wall Coverings Only: Paper-faced flexible gypsum board; installed in two layers.

3. Shaft-Side Face of Shaft-Liner Assemblies:

a. No Finish Required: Moisture-resistant paperless glass mat shaft-liner gypsum board.

C. Incidental Exposure: Surfaces immediately adjacent to water and / or moisture sources including, but not limited to, the following locations:

1. Walls and ceilings in mechanical equipment rooms and janitor closets.
2. Walls within 24 inches of centerline of drinking fountains, isolated wall-hung lavatories, and countertop sinks and other similar water sources.
3. Interior face of exterior walls.
4. Acceptable gypsum board products for the above listed conditions:

a. Paint and Wall Coverings: Moisture-resistant paper-faced or moisture-resistant paperless glass-mat gypsum board.
b. Tile: Moisture-resistant coated-glass-mat gypsum board.

5. Top of walls above ceilings adjacent to mechanical equipment in corridors.

a. Moisture-resistant paperless glass-mat gypsum board.

D. Direct Exposure: Surfaces normally soaked, saturated, or regularly and frequently exposed to water and / or moisture including, but not limited to, the following locations:

1. Walls and ceilings in toilet rooms and bathrooms including bathtubs and showers:

a. Paint and Wall Coverings: Moisture-resistant paper-faced or moisture-resistant paperless glass-mat gypsum board.
b. Tile: Moisture-resistant coated-glass-mat gypsum board.

3.15 GYPSUM BOARD FINISHING SCHEDULE

A. Gypsum Board Finishing Schedule, General: Finish panels to Levels of Finish indicated below. Apply joint tape over panel joints, except those with trim having flanges not intended for tape. Sand between coats and after last coat to produce a surface free of defects and ready for applied finish system.

1. Levels of Finish: According to ASTM C 840.

B. Preparation: Apply joint compound at open joints, panel edges, and damaged surface areas.

C. Level 1: At following locations, embed tape at joints in joint compound unless a higher level of finish is required for fire resistance rated assemblies. Trim accessories to be installed but not embedded in joint compound unless required for fire rating:

1. Ceiling plenum areas above ceilings.
2. Concealed areas.

D. Level 2: At following locations, embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges:

1. Substrate for tiling.

E. Level 3: At following locations, embed tape and apply separate first and second coats of joint compound to tape, fasteners, and trim flanges:

1. Mechanical, electrical, data and elevator equipment rooms.

F. Level 4: At following locations, embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges:

1. Areas to receive paint.
2. Areas to receive wall coverings.

G. Level 5: At following locations, embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound or Level 5 Primer and Surfacer over entire surface:

1. Curved ceilings and partitions.
2. Other locations indicated on drawings.

END OF SECTION

# SECTION 09 3000

# TILING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Modular tiles, membrane underlayments, setting materials, grouting materials, accessories, and supplementary items necessary for installation.

### 1.2 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 and ANSI A137.3 apply to Work of this Section unless otherwise specified.

B. Module Size: Actual tile size plus joint width indicated.

C. Face Size: Actual tile size, excluding spacer lugs.

D. LHT: Large and Heavy Tile. Tiles are typically larger than 8 in by 8 in (200 mm by 200 mm) or with at least one side greater than 15 in (375 mm) or weigh 5 psf (239 Pa) or heavier and have an ungauged thickness.

E. Porcelain Tile: A ceramic tile or paver tile that is generally made by the dust-pressed method of a composition resulting in a tile that is dense, impervious, fine grained, and smooth with sharply formed face.

F. Gauged Porcelain Tile Panels/Slabs: A ceramic tile or panel size greater than or equal to 11 sq ft (1 sq m).

### 1.3 ACTION SUBMITTALS

A. Product Data: Manufacturers technical literature for each product and system indicated.

1. Include manufacturers specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings:

1. Include plans of rooms and elevations of walls showing tile and patterns; include sections showing underlayments, setting materials, and grouting materials.
2. Include details showing widths and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification Purposes: Submit samples for each item listed below of size and construction indicated. Where products involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Tile: Each type and composition of tile and for each color and finish required, at least 12 in (300 mm) square, mounted on rigid panel, and with grouted joints using product complying with specified requirements and in color approved for completed work.
2. Tile Trim and Accessories: Full-size units of each type and for each color required.
3. Stone Thresholds: 6 in (150 mm) lengths of specified profile.
4. Metal Edge Strips: 6 in (150 mm) lengths of specified profile.

1.4 INFORMATIONAL SUBMITTALS

A. List of Materials for Layered Mock-Up for Construction Quality Purposes:

1. Product, material, and equipment names, model numbers, lot numbers, batch numbers, source of supply, and other information required to identify items used.
2. Receipt of list does not constitute acceptance of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.

B. Field Quality Control Reports: Written report of testing and inspection required by Field Quality Control.

C. Warranty:

1. Provide manufacturers written warranty covering materials and installation (labor) stating obligations, remedies, limitations, and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Instructions: Include in operation and maintenance manual required by Division 01 Section Closeout Requirements. Submit manufacturers instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

A. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.
b. Build mock-ups in a layered fashion omitting tile in particular areas to reveal underlayment membranes and setting bed installation including but not limited to the following:

1) Tiled floor conditions at thin-set mortar setting beds.
2) Tiled floor conditions at LHT mortar setting beds.
3) Tiled floor conditions at thick-set mortar setting beds.
4) Movement joints at tiled floor conditions.

5) Tiled shower stall including three walls, floor, curb, and threshold.
6) Tiled wall conditions, including one interior corner.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.8 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.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Install tile only when construction in room is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.11 WARRANTY

A. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. Defects is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section Substitution Procedures.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1. Tile: For each tile, obtain of same color, finish, composition, and type, from same source and production run.
2. Setting and Grouting Materials: Obtain ingredients of uniform quality for each mortar and grout component from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. Slip Resistance Requirements for Floor Tile:

1. Standards: Products and installation shall comply with ANSI A137.1, and state and local accessibility standards.
2. Floor Tile Slip Resistance: For tile installed on walkway surfaces, provide products with the following value as determined by testing identical products by the DCOF AcuTest Method per ANSI A326.3:

a. Walkway Surfaces: Minimum 0.42.

2.4 CERAMIC TILE PRODUCTS

A. Material Quality Standard: ANSI A137.1 Specifications for Ceramic Tiling and ANSI A137.3 Specifications for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs for types, compositions, and grades of tiling indicated.

1. Furnish tiling complying with Standard Grade requirements, unless otherwise indicated.

B. Ceramic Tile, General: Thin ceramic surfacing unit made from clay, porcelain, or mixture of ceramic materials, glazed or unglazed, fired above red heat to temperature sufficient to produce specific physical properties and characteristics specified.

C. Factory Blending: For tile exhibiting color variations, blend tile in factory and package so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.

D. Mounting: Where factory-mounted tile is used, provide back- or edge-mounted tile assemblies as standard with manufacturer. Where tile is intended for installation in wet exposure areas, do not use factory mounted tile assemblies unless tile manufacturer states that this type of mounting is suitable for installation indicated.

E. Factory-Applied Temporary Protective Coating for Epoxy Grout Installations: Where recommended by tile and grout manufacturer, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating tile face surfaces with a continuous protective film that is easily removable without damaging tile or grout. Do not coat unexposed tile surfaces.

2.5 WATERPROOF MEMBRANE UNDERLAYMENTS FOR INTERIOR APPLICATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is acceptable to authorities having jurisdiction for use as shower pan waterproofing, as selected from one of the following available options. Include primer, pre-fabricated corners, seaming cement, detail tape, sealant, and other standard accessory products required for application provided by membrane manufacturer.

B. Faced Plastic Waterproof Membrane Underlayments:

1. Faced Chlorinated Polyethylene (CPE):

a. Description: Non-plasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric; minimum 0.030 in (0.75 mm) nominal thickness.
b. Manufacturers and Products:

1) The Noble Company; Nobleseal TS.
2) Laticrete; Hydro Ban Sheet Membrane.

2. Faced Polyvinyl Chloride (PVC):

a. Description: ASTM D 4551, multiple layers of polyvinyl chloride sheet heat-fused together and to facings of bondable nonwoven polyester; minimum 0.040 in (1.0 mm) nominal thickness.
b. Manufacturer and Product: Compotite Corporation; Composeal Gold.

3. Locations: Thin-set installations at floors, walls, and ceiling; including thin-set shower pan floor installations.

2.6 CRACK ISOLATION MEMBRANE UNDERLAYMENTS

A. General: Manufacturers standard product that complies with ANSI A118.12 as selected from one of the following available options. Include primer, pre-fabricated corners, seaming cement, detail tape, sealant, and other standard accessory products required for application provided by membrane manufacturer.

B. Fluid-Applied Crack Isolation Membrane Underlayment: Not permitted or allowed within shower and bathtub areas.

1. Description: Manufacturers proprietary system consisting of liquid applied component and synthetic fabric sheet reinforcement.
2. Manufacturers and Products:

a. ARDEX Engineered Cements; Ardex 8 + 9 Waterproofing and Crack Isolation Membrane.
b. Custom Building Products; 9240 Waterproofing and Crack Isolation Membrane.
c. Laticrete International Inc.; Laticrete 9235 Waterproof Membrane.
d. Laticrete International Inc.; Blue 92 Anti-Fracture Membrane.
e. Mapei Corp.; Mapelastic 400.

C. Faced Chlorinated Polyethylene (CPE) Crack Isolation Membrane Underlayment:

1. Description: Non-plasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric; minimum 0.030 in (0.75 mm) nominal thickness.
2. Manufacturer and Product: The Noble Company; NobleSeal CIS.

2.7 SETTING (MORTAR AND GROUT) MATERIALS

A. Material Quality Standards: ANSI A118 Series as indicated.

B. LHT Latex-Portland Cement Mortar:

1. Material Quality Standard: ANSI A118.4 and ANSI A118.15, with the following physical properties:

a. Manufacturer's premium polymer modified LHT mortar product; gray color. Use white color with light colored stone, translucent marble or light color grout as recommended by manufacturer.
b. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
c. Non-sag capability.
d. Suitable for use in LHT mortar beds up to 1/2 in (12 mm) thick.

2. Manufacturers and Products - Floor Tiling:

a. ARDEX Engineered Cements; X 77 Microtec.
b. Custom Building Products; ProLite Tile & Stone Mortar.
c. Laticrete International, Inc.; Laticrete Tri-Lite Large and Heavy Tile Mortar.
d. Mapei Corp.; Ultraflex 3 Mortar.

3. Manufacturers and Products - Gauged Tile Panels / Slabs:

a. Comply with ANSI A108.19 Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar.
b. Confirm with tile manufacturer and mortar setting material manufacturers the use of required setting materials, methods and cure times.

C. Thin-Set Latex-Portland Cement Mortar (For All Tile Types Except Glass):

1. Material Quality Standard: ANSI A118.4 and ANSI A118.15, with the following physical properties:

   a. Manufacturer's premium polymer modified thin-set product; gray color. Use white color with light colored stone, translucent marble or light color grout as recommended by manufacturer.
   b. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
   c. Non-sag capability.
   d. Suitable for use in thin set mortar beds up to 1/4 in (6 mm) thick.

2. Manufacturers and Products - Floor Tiling:

   a. ARDEX Engineered Cements; X 77 Microtec.
   b. Custom Building Products; ProLite Tile & Stone Mortar.
   c. Laticrete International, Inc.; Laticrete 254 Platinum Thin-Set Mortar.
   d. Mapei Corp.; Ultraflex 3 Mortar.

3. Manufacturers and Products - Wall Tiling:

   a. ARDEX Engineered Cements; X 77 Microtec.
   b. Custom Building Products; ProLite Tile & Stone Mortar.
   c. Laticrete International, Inc.; Laticrete Tri-Lite Large and Heavy Tile Mortar.
   d. Mapei Corp.; Ultraflex 3 Mortar.

D. Rapid Set Mortar:

1. Material Quality Standard: ANSI A108.1, manufacturers premium, rapid setting, rapid hardening, polymer-modified cement based sloping mortar for leveling and ramping substrates.
2. Basis of Design - Manufacturer and Product:

   a. Custom Building Products; SpeedSlope - Rapid Setting Sloping Mortar.

E. Epoxy Grout: High performance epoxy grout; provides high degree of stain resistance; cleanable to the original color.

1. Material Quality Standard: ANSI A118.3.
2. Manufacturers and Products:

   a. H. B. Fuller Construction Products, Inc. TEC Brand; AccuColor EFX Epoxy Grout.
   b. Laticrete International, Inc.; SpectraLOCK PRO Premium Grout.
   c. Mapei Corp.; Kerapoxy CQ.

2.8 ELASTOMERIC SEALANTS

A. Sealant Colors: Match color of adjacent grout unless otherwise indicated.

B. Mildew-Resistant Floor or Wall Joint Sealant:

1. Material Quality Standard: ASTM C 920, Type S, Grade NS, Class 25, with following physical properties:

    a. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
    b. Intended for sealing interior ceramic tile joints and other nonporous substrates.
    c. Resistant to in-service exposures of high humidity and temperature extremes.

2. Description: One-part mildew-resistant silicone sealant.
3. Manufacturers and Products:

    a. ARDEX Engineered Cements; SX.
    b. Custom Building Products; Commercial 100% Silicone Caulk.
    c. Dow Corning Corp.; 786.
    d. Laticrete International, Inc.; Latasil.
    e. Pecora Corp.; 898.
    f. Tremco Inc.; Tremsil 200.

C. Backer Rods:

1. Material Quality Standard: ASTM C 1330, Type B.
2. Description: Non-gassing (when punctured), bi-cellular polyethylene or polyolefin foam rod with a surface skin, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
3. Manufacturers and Products:

    a. BASF Construction Chemicals; MasterSeal 921 (Formerly Sonneborn Soft Backer Rod).
    b. Nomaco Inc.; Sof Rod.

D. Backer Tape: Bond-breaking polyethylene or other plastic tape, self-adhesive where applicable, recommended by sealant manufacturer for preventing sealant from adhering to back of joint where such adhesion would result in sealant failure.

2.9 RELATED MATERIALS

A. Cementitious Underlayments: Trowelable or self-leveling as required by conditions; pre-mixed, latex-modified, Portland cement based formulation provided by or specifically approved by setting material manufacturer; include primers if required for concrete substrate condition.

B. Patching Compounds: Trowelable pre-mixed, latex-modified, Portland cement based formulation provided by or specifically approved by setting material manufacturer; include primers if required for concrete substrate condition.

C. Metal Transition Strips (Tile to Adjacent Flooring Material):

1. Schluter Systems LP; Schiene, aluminum.

D. Metal Transition Coves (Floor to Wall):

1. Schluter Systems LP; DILEX, aluminum or stainless steel, as noted on drawings.

E.

F. Stone Threshold:

1. Material Quality Standard: MIA Group A.
2. Description: White marble with honed finish.
3. Fabrication: Of shape and width to allow top at no more than 1/2 in (12 mm) above adjoining finished floor surface and both edges beveled on a slope no greater than 1:2 and as indicated in the Drawings.

G. Glass-Fiber Tape: Self-adhering, alkali-resistant, glass-fiber tape, 10 by 10 or 10 by 20 threads per 1 in (25 mm).; minimum 2 in (50 mm) wide.

H. Tile Cleaner: Neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, provided by or specifically approved by tile and grout manufacturers.

I. Grout Sealer: Manufacturers standard silicone product for sealing grout joints and that does not change color or appearance of grout.

2.10 MIXING MORTARS AND GROUT

A. General Procedures:

1. Mix to comply with referenced quality standards and manufacturers written instructions.
2. Add materials, water, and additives in accurate proportions.
3. Use type of mixing equipment, speeds, containers, time, and other procedures to produce uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrate surfaces to which tile will be installed for compliance with requirements, installation tolerances, and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with the Contract Documents. Starting work within a particular area will be construed as acceptance.

1. 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.
2. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standard: In addition to standards listed elsewhere, perform tile work according to following, unless otherwise specified:

1. Respective manufacturers written installation instructions.
2. Accepted submittals.

3. Contract Documents.
4. ANSI A108 installation method indicated.
5. TCNA installation method indicated.

B. General Requirements:

1. Extend tile into recesses and under or behind equipment and fixtures to form a complete covering without interruptions unless otherwise indicated.
2. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Accurately form intersections and returns.
4. Perform cutting and drilling of tile without marring visible surfaces.
5. Grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints, to form smooth edges.
6. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile by not less than 1/8 in (3 mm).

C. Jointing Pattern:

1. Unless otherwise indicated, lay tile in grid pattern.
2. Align joints when adjoining tiles on floor, base, walls, and trim are same size.
3. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting.
4. Provide uniform joint widths of size recommended by tile and grout manufacturer unless otherwise indicated.
5. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.

D. Wainscots: Lay out tile to next full tile beyond dimensions indicated, and finish with bullnose shape.

3.3 PREPARATION

A. General: Comply with manufacturers instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Substrate Cleaning: Remove curing compounds, coatings, laitance, efflorescence, concrete dust, dirt, oil, gypsum board dust, paint, and other residue that would adversely affect or reduce bonding.

C. Concrete Floor Preparation:

1. Prepare concrete floor substrates to comply with flatness tolerance of 1/4 in in 10 ft (6 mm in 3 m) as follows:

a. Fill cracks, holes and depressions with trowelable cementitious underlayments and patching compounds.
b. Remove concrete protrusions, bumps, and ridges by sanding or grinding.

2. If substrate does not have fine broom finish, mechanically scarify concrete substrates to not less than ICRI CSP 4 finish.
3. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 in per foot (1:50) toward drains.

D. Substrate Joints, Gaps, Penetrations, and Different Substrates within Shower and Tub Enclosures: Prior to installing tile, seal the following joints, gaps, and spaces between differing materials as follows:

1. Base of Wall Joints within Shower and Tub Enclosures: Apply wall joint sealant at joint between Coated Glass-Mat Water Resistant Board (specified in Division 09 Section Gypsum Board Assemblies) and Tub Enclosure or Prefabricated Shower Receptor, Thick-set Mortar Bed, or floor slab to create water resistant barrier in accordance with TCNA Installation B420.
2. Penetrations: Apply wall joint sealant at penetrations through wall substrates to create water resistant barrier; especially at piping and valve penetrations.
3. Toilet Accessories: Apply wall joint sealant at fastener penetrations and around perimeter of backing plates to create water resistant barrier.
4. Joints and Corners: Apply glass-fiber tape to joints and corners of substrates within Showers and Tub Enclosures with thin-set mortar.

E. Blending: Verify tile has been factory blended and packaged as specified; if not, either return to manufacturer or blend tiles at site before installing.

F. Field-Applied Temporary Protective Coating: Where needed to prevent grout from staining or adhering to exposed tile surfaces, pre-coat with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

## 3.4 WATERPROOF MEMBRANE UNDERLAYMENT INSTALLATION

A. Installation Quality Standard: ANSI A108.13 and manufacturers written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. General Requirements:

1. If required by manufacturer, prime concrete substrate.
2. Install to produce a continuous waterproof membrane of uniform thickness bonded securely to substrate, without wrinkles, bubbles, buckles or kinks.
3. For sheets, overlap and seal seams.
4. Turn membrane up wall at locations where tile is scheduled for wall or base.
5. Roll installed sheet if required by manufacturer.
6. Install tile after waterproofing has cured and been tested determined it is watertight.

## 3.5 CRACK ISOLATION MEMBRANE UNDERLAYMENT INSTALLATION

A. General Requirements:

1. If required by manufacturer, prime concrete substrate.
2. Install to produce a continuous crack isolation membrane of uniform thickness bonded securely to substrate, without wrinkles, bubbles, buckles, or kinks.
3. For sheets, overlap and seal seams.

4. For liquid applied products, brush or roll liquid uniformly over area in number of coats required and install reinforcing fabric.
5. Roll installed sheet if required by manufacturer.
6. After installation of tile, install floor joint sealant in tile joints recommended by manufacturer to coordinate with membrane strips.

3.6 TILE INSTALLATION

A. Comply with TCNAs Handbook for Ceramic 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. Installation Quality Standard: Install tile according to following standards:

1. LHT Mortar: ANSI A108.5; for floor tiles larger than 8 in by 8 in (200 mm by 200 mm) or with at least one side greater than 15 in (375 mm) and where subfloor is not recessed.
2. Thin-set Latex-Portland Cement Mortar: ANSI A108.5; for floor tiles 8 in by 8 in (200 mm by 200 mm) and smaller where subfloor is not recessed; and for interior wall tiles.
3. Epoxy Grout: ANSI A108.9, where indicated.
4. Interior Gauged Porcelain Tiles and Panels/Slabs: A108.19

C. Back Buttering: For following installations, obtain minimum 95 percent mortar coverage as in referenced ANSI A108 series of installation standards:

1. Tile floors and ceilings in wet and limited water exposures.
2. Tile floors composed of tiles 12 in by 12 in (300 mm by 300 mm) or larger.
3. Tile floors composed of rib-backed tiles.

D. Grout Joint Widths: Install the respective types of tile with the following grout joint widths, unless otherwise recommended by tiling and grout manufacturers.

1. Ceramic Mosaic Tile - Less than 6 sq in (3900 mm²): 1/16 in (1.5 mm).
2. Paver Tile - 6 sq in (3900 mm²) or More: 1/4 in (6 mm).

E. Stone Thresholds: Install at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated. Where edge of mortar bed would be exposed, set in thin-set mortar.

F. Metal Trim: Install at locations indicated and where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

G. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.7 MOVEMENT JOINTS

A. Movement Joints, General: Installation Quality Standard: In accordance with TCNA Movement Joint Design Essentials EJ171 and as specified below.

B. Wall Joints: The following conditions shall not be grouted; install wall joint sealant and backer rod or backer tape:

1. Gypsum board assembly control joints.
2. Building expansion joints, unless scheduled for expansion joint cover.
3. Interior corners of tiled walls, including shower and bathtub walls.
4. Around substrates and tile at penetrations through tiled substrates.
5. At one side of changes in direction or plane of wall.
6. At joint closest and parallel to changes in substrates supporting tile between wall and floor.

C. Floor Joints:

1. General Requirements:

a. Where full coverage crack isolation membrane is not provided, continue construction, contraction (control), and expansion joints in building structure through tile work.
b. Isolate tile work that abuts a restraining structure or assembly.
c. When metal trim or sealant/backer is used for joint, width shall not be less than width of joint in building structure.
d. Tile shall not be placed over building expansion joints.

2. Schedule of Sealant Products and Locations:

a. Grouted Floors: Install floor joint sealant with backer rod at horizontal joints in mortar and grout setting conditions.

3. Interior Movement Joint Spacing: As indicated on Drawings and as specified below:

a. Tile Exposed to Direct Sunlight or Moisture: 8 ft to 12 ft (2.4 m to 3.6 m) on center each way.
b. Tile Not Exposed to Sunlight: 20 ft to 25 ft (6 m to 7.5 m) on center each way.

D. Interior Floor Joint Installation Schedule: Seal interior floor movement joints, as defined by TCNA, according to following schedule:

1. Construction Joints: Floor joint sealant and backer rod.
2. Contraction (Control) Joints: Floor joint sealant and backer rod.
3. Isolation Joints: Floor joint sealant and backer rod.
4. Tile Expansion Joints: Floor joint sealant and backer rod.
5. Perimeter Joints between Wall and Floors: Floor joint sealant with backer tape.

3.8 FIELD QUALITY CONTROL

A. Shower Receptor Test: Where shower floors and receptors are made water-tight by the application of the waterproof membrane, the completed membrane installation shall be tested at each installation.

1. The pipe from the shower drain shall be plugged and the receptor area shall be filled with water to a depth of not less than 2 in (50 mm) measured at the threshold.

2. Where a threshold of adequate height does not exist a temporary threshold shall be constructed to retain the test water to the stated depth.
3. The water shall be retained for a test period of not less than 24 hours, and there shall not be evidence of leakage.
4. Report results of tests, both successful and unsuccessful. In addition to results, report shall include date of test, project name, list of products being applied and tested, name of applicator, name of Contractor, and conditions causing failure of waterproofing membrane in event of an unsuccessful test.
5. Materials and installations failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense

3.9 CLEANING

A. Cleaning:

1. Acids are not permitted, nor will they be allowed.
2. Clean tile surfaces so they are free of foreign matter.
3. Remove grout residue from tile as soon as possible.
4. No sooner than 10 days after installation, clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. 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.
5. Protect metal surfaces and plumbing fixtures from effects of cleaning.
6. Flush surfaces with clean water before and after cleaning.
7. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

3.10 DEMONSTRATION

A. Cleaning and Maintenance Training: Provide instruction to Owner's personnel for cleaning and maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use; include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

3.11 PROTECTION

A. Coverings: When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

B. Traffic Restrictions: Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

3.12 INTERIOR TILE INSTALLATION SCHEDULE

A. Floors, Concrete Substrate:

1. TCNA Installation Method F125-Full (Crack Isolation Membrane; full coverage): Thin-set Latex-Portland cement mortar over crack isolation membrane over concrete subfloor; Epoxy Grout.

a. Location: Where scheduled in the Room Finish Schedule located on the drawings and in all thin-set tile locations which have neither waterproofing nor sound isolation scheduled.

2. TCNA Installation Method F122 (Waterproof Membrane): Thin-set Latex-Portland cement mortar over waterproof membrane over concrete subfloor; Epoxy Grout.

a. Location: As scheduled in the Room Finish Schedule located on the drawings, all toilet rooms, above grade.

B. Walls, Gypsum Board Substrate:

1. TCNA Installation Method W243: Thin-set Latex-Portland cement mortar over coated-glass-mat gypsum board; Epoxy Grout.

C. Walls, Gypsum Board Substrate, Bathtub / Shower Surfaces:

1. Walls, Including Tub Unit or Pre-Fabricated Shower Receptors: TCNA Installation Method B419 (Waterproof Membrane): Thin-set Latex-Portland cement mortar over waterproof membrane over coated-glass-mat gypsum board; Epoxy Grout.
2. Shower Receptors: TCNA Installation Method B420 (Waterproof Membrane): Thin-set Latex-Portland cement mortar over waterproof membrane over coated-glass-mat gypsum board walls and concrete subfloors; Epoxy Grout.

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 09 5113

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Acoustical lay-in ceiling panels, exposed metal suspension systems, and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

C. Samples for Verification Purposes: Full-size units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1. Acoustical Panels: Set of 6 in (150 mm) square samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 12 in (300 mm) long samples of each type, finish, and color.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.4 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. This is the Campus standard.

1. Armstrong World Industries, Inc.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1. Obtain both acoustical ceiling panels and suspension system from the same manufacturer if both are offered by the manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Products and systems shall be engineered to withstand loads within limits of allowable working stresses of the materials involved under conditions indicated and without permanent deformation or failure of materials.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 450 or less.

2.4 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical

ratings, and light reflectance's, unless otherwise indicated.

1. Selections: As scheduled or as indicated in Design Selections.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times design load indicated in ASTM C 635/C 635, Table 1, Direct Hung, unless otherwise indicated.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Cast-in-place anchors, designed for attachment to concrete.
b. Post-installed expansion anchors.
c. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 for Class SC1 service condition.

2. Powder-Actuated Anchors: Suitable for application indicated, ANSI A10.3; low velocity, powder-actuated fasteners; drive pins and clip angles fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

a. Manufacturers:

1) Construction Materials, Inc.
2) Heckman Building Products, Inc.
3) Hilti Corp.
4) ITW Ramset/Red Head.
5) Powers Fasteners.
6) Simpson Strong Tie Anchor Systems.

3. For post-tensioned concrete, anchors shall not exceed 1 in (25 mm) embedment. Obtain Structural Engineer's written approval for all proposed anchors in post-tensioned concrete prior to installation.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Wire:

a. Zinc-Coated Carbon-Steel Wire: ASTM A 641 / A 641M, Class 1 zinc coating, soft temper.
b. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic; for use at MRI and related spaces.

2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635/C 635M, Table 1, "ÓÓDirect Hung"□) will be less than yield stress of wire, but provide not less than 0.106 in (2.69 mm) diameter wire.

E. Edge Moldings and Trim: Manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.
4. Where required by Code or authorities having jurisdiction, provide 2 in (50 mm) wide wall angle around the ceiling perimeter in Seismic Design Categories D, E, and F.
5. Round Column Angle Molding:

a. Basis of Design: Fry Reglet Corporation; "Column Collar", extruded aluminum with PVC spacer, size as required for column diameter, finish to match suspension system.

F. Specialty Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
2. Basis of Design (Product Standard) Manufacturer and Product: Armstrong World Industries, Inc.; Axiom series, with manufacturer's 30 year warranty.
3. Indirect Light Coves, where indicated on drawings.

G. Sealant for Concealed Joints: Manufacturer's standard nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints.

## 2.6 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILINGS

A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653 / A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16 in (24 mm) wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.

2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flush face.
4. Cap Material: Steel sheet.
5. Cap Finish: Painted white, unless indicated otherwise.
6. Manufacturers and Products:

    a. Armstrong World Industries, Inc.; Prelude XL.
    b. CertainTeed Corporation; Classic Stab.
    c. Chicago Metallic Corporation; 1200 System.
    d. USG Interiors, Inc.; Donn DX.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

    1. Respective manufacturer's written installation instructions.
    2. Accepted submittals.
    3. Contract Documents.

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

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

C. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.4 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

A. Installation Quality Standard: In addition to standards listed elsewhere, perform suspended

ceiling work according to following, unless otherwise specified in this Section:

1. ASTM C 636 / C 636M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with mechanical and electrical equipment, insulation, or other objects within ceiling plenum that are not part of supporting structural frame or ceiling suspension system. Within limitations allowed by installation quality standards, 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 location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by installation quality standards.
3. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
4. Do not support ceilings directly from permanent metal forms. Fasten hangers to cast-in-place hanger inserts, power-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
5. Do not attach hangers to steel deck tabs.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Space hangers not more than 48 in (1200 mm) on center along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 in (200 mm) from ends of each member.
8. Do not connect or suspend any ceiling components from ducts, pipes or conduit.
9. Do not make local kinks or bends in hanger wires as a means of leveling.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors. Install compression struts to meet seismic requirements.

D. Install edge moldings and trim at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Screw attach moldings to substrate at intervals not more than 16 in (400 mm) on center and not more than 3 in (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 in per 12 ft (3 mm per 3.6 m). Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
3. Provide control joints where joints occur in abutting surfaces.
4. Hold tees in place with concealed clips.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

1. Space steel main runners at 48 in (1200 mm) on center.

F. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels with pattern running in one direction parallel to long axis of space.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.5 PROTECTION

A. Protect products and systems from damage during installation and remainder of construction period according to manufacturer's instructions.

3.6 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 09 6116

LIQUID FLOOR HARDENER

PART 1 - GENERAL

1.1 SUMMARY

A. Work required of this Section includes a penetrating liquid floor hardener and sealer applied to interior concrete surfaces along with supplementary items necessary to complete work required for their installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit to include in manual specified in Division 01 Section "Closeout Procedures". Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of coatings.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 2 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 2 years of experience installing products and systems similar to scope of this Project.

B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.

3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Coverage of warranty includes but is not limited to the following: Degradation of dust proofing capabilities from abrasion.
2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 LIQUID FLOOR HARDENER

A. Penetrating Liquid Floor Hardener and Sealer: Chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, densifies, and seals concrete surfaces.

1. Manufacturers and Products:

a. Curecrete Distribution, Inc.; Ashford Formula
b. Euclid Chemical Company (The); Euco Diamond Hard
c. L&M Construction Chemicals, Inc.; Seal Hard

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

### 3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

### 3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

### 3.4 INSTALLATION, LIQUID FLOOR HARDENER

A. Liquid Floor Hardener: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions including preparation, application, precautions, limitations, and compatibility with other surface conditions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days old unless recommended by manufacturer in written literature describing application procedure, but only with prior approval of Architect.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
4. Locations:

    a. Where indicated on room finish schedule or on drawings, including exposed concrete floors noted or scheduled as having "sealed concrete" or similar wording.

3.5 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 09 6500

RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resilient flooring products and systems and supplementary items necessary for installation.

1. Resilient sheet flooring.

B. Related Section:

1. Resilient wall base, reducer strips, and other accessories installed with resilient flooring are specified in Division 09 Section "Resilient Base and Accessories".

1.2 ALLOWANCES

A. Concrete Moisture Barrier Allowance: Include allowance to provide Concrete Moisture Barrier Floor Treatment to concrete floor decks.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, recommended adhesives, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings for Special Patterns: Show layout and details of special patterns for resilient flooring.

C. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

D. Samples for Verification Purposes: In manufacturer's standard size, but not less than 6 in by 9 in (150 mm by 230 mm) sample of each different color and pattern of resilient flooring product specified, showing the full range of variations expected in these characteristics. Label each sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in Schedules.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

1. Product Compatibility: On installations incorporating products provided by more than one manufacturer, each manufacturer's certificate shall include specific reference to and approval of the other manufacturer's products.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Instructions: Include in operation and maintenance manual as required by Division 01 Section "Closeout Procedures". Submit manufacturer's instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

A. Slip Resistance: Provide products identical to those tested for slip resistance per ASTM D 2047 with a static coefficient of friction not less than 0.6 for level surfaces and 0.8 for ramped surfaces.

B. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: Class I, 0.45 W/sq. cm or greater when tested per ASTM E 648.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. LVT manufacturer's qualified technical representative for each product specified
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store flooring products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C).

1. Resilient Sheet Flooring: Store sheet flooring rolls upright.

1.9 PROJECT CONDITIONS

A. Unless otherwise approved in writing by the manufacturer, do not begin flooring installation unless permanent building HVAC system is operational and capable of maintaining relative humidity and temperature of not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C) for at least 48 hours before installation, during installation, and after installation.

1. Maintain relative humidity of not more than the designed relative humidity for spaces to receive flooring.

B. Maintain flooring products prior to installation at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during flooring installation and for time period after installation recommended by manufacturer.

D. Install flooring products after other finishing operations, including painting, have been completed.

E. Do not install flooring over concrete substrates until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended tests. Refer to "Preparation" Article for requirements.

1.10 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 RESILIENT SHEET FLOORING MATERIALS

A. Vinyl Sheet Floor Coverings: ASTM F 1303, Type I or II, Grade 1, Class A (fibrous) or B (nonfoamed plastic) backing or ASTM F 1913 unbacked as required by product selection.

B. Sheet Flooring Thickness: 0.125 in (3 mm).

C. Heat-Welding Seam Bead: Solid-strand product of floor covering manufacturer for heat welding seams.

1. Selections: As scheduled or as indicated in Design Selections.

D. Integral Cove Base Accessories: Resilient accessories recommended by flooring manufacturer with selections as follows:

1. Basis of Design: Burke Mercer Flooring Products; Division of Burke Industries, Inc.

a. Cap Strip: No. 040 round vinyl cap.
b. Cove Strip: No. 070 flexible vinyl cove stick with nominal 1 in (25 mm) radius.
c. Reducer: No. 633 vinyl reducer, 1 in (25 mm) wide by 1/8 in (3 mm) high.

2.4 ACCESSORY MATERIALS

A. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

B. Trowelable Leveling and Patching Compounds: Latex-modified, Portland-cement-based formulation provided or approved by flooring manufacturer for products and applications indicated.

C. Adhesives: Water-resistant type recommended by flooring manufacturer suitable for products, applications, and substrate conditions indicated.

1. Product Compatibility: Provide Manufacturer's written recommendation for each product within an assembly. On installations incorporating products provided by more than one manufacturer, each manufacturer shall approve in writing all adhesives that are in contact with their products.

D. Concrete Moisture Barrier Floor Treatment:

1. Epoxy-Based Moisture Barrier Floor Treatment: Two-component, high-performance, non-flammable, rapid drying, water based, low odor, low VOC, two-component, penetrating epoxy; formulated to reduce moisture vapor transmission and surface alkalinity from concrete substrates, including aged or freshly placed ("green") concrete, prior to installation of impervious glued-down finish flooring specified in other Division 09 sections.

a. Basis of Design (Product Standard): Bostik, Inc.; D-250.

2. Cementitious Overcoat: Fast-setting latex-fortified Portland cement skim coating intended for interior uses.

a. Basis of Design (Product Standard): Bostik, Inc.; Webcrete 95.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that concrete substrate finishes comply with requirements specified in Division 03 Section "Concrete Finishing" for concrete substrates receiving resilient flooring.
2. Verify that concrete substrates are free of cracks, ridges, depressions, scale, and foreign deposits.
3. Verify that concrete substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Unless concrete has been water-cured, then proceed with the following:

   a. Bead-blast concrete substrate with an apparatus that abrades the surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
   b. Repair damaged and deteriorated concrete according to flooring manufacturer's written recommendations.

4. Determine adhesion and dryness characteristics by performing the following tests as recommended by flooring manufacturer.
5. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. A pH range of 5 to 9 is required when substrate is wetted with distilled water and pHydrion paper is applied. Proceed with installation only after concrete substrates pass testing.
6. Moisture Testing: Perform one or both of the following tests as recommended by flooring manufacturer. Perform 3 moisture tests for first 1000 sf (92.9 sm) of concrete substrate scheduled to receive flooring and 1 test for each additional 1000 sf (92.9 sm) or fraction thereof. Proceed with installation only after concrete substrates pass testing.

a. Perform anhydrous calcium chloride test in accordance with ASTM F 1869. Proceed with installation only after concrete substrates have maximum moisture-vapor-emission rate of 3 lbs of water/1000 sf (1.36 kg of water/92.9 sm) in 24 hours.
b. Perform relative humidity test using in situ probes in accordance with ASTM F 2170. Proceed with installation only after concrete substrates have a maximum 75 percent relative humidity level measurement.

7. Moisture Barrier Floor Treatment: For concrete substrates not meeting moisture test standards specified above, apply epoxy-based moisture floor treatment and cementitious overcoat to concrete substrate in accordance with manufacturer's written instructions.

C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

D. Broom and vacuum clean substrates to be covered immediately before flooring product installation. After cleaning, reexamine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.4 INSTALLATION OF RESILIENT FLOORING, GENERAL

A. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings. Extend flooring to center of door openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on substrate. Use chalk or other nonpermanent, non-staining marking device.

E. Adhere flooring to substrates using a full spread of adhesive applied to substrate to comply with flooring manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

F. Hand-roll flooring in both directions from center out to embed flooring in adhesive and eliminate trapped air according to manufacturer's written instructions. At walls, door casings, and other locations where access by roller is impractical, press flooring firmly in place with flat-bladed instrument.

3.5 INSTALLATION OF RESILIENT SHEET FLOORING

A. Unroll sheet flooring and allow it to stabilize before cutting and fitting, if recommended in writing by manufacturer.

B. Lay out sheet flooring to comply with the following requirements:

1. Maintain uniformity of sheet flooring direction.
2. Arrange for a minimum number of seams and place them in inconspicuous and low-traffic areas, and not less than 6 in (150 mm) away from parallel joints in flooring substrates.
3. Match edges of sheet flooring for color shading and pattern at seams according to manufacturer's written recommendations.
4. Avoid cross seams.

C. Integral Cove Base: Form integral cove base by flashing sheet flooring up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt flooring at top of base against cap strip.

D. Heat-Welded Seams: Rout joints and heat weld with welding bead, permanently fusing sections into seamless flooring. Prepare, weld, and finish seams according to manufacturer's written instructions and ASTM F 1516 to produce surfaces flush with adjoining flooring surfaces.

3.6 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing flooring products:

1. Remove adhesive and other surface blemishes from exposed surfaces using cleaner recommended by flooring manufacturer.
2. Sweep or vacuum floor thoroughly.
3. Do not wash floor until after time period recommended by flooring manufacturer.
4. Damp-mop floor to remove marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by flooring manufacturer.

1. Cover products installed on floor surfaces with undyed, untreated building paper until just prior to Substantial Completion.
2. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

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EL PASO, TEXAS

SECTION 09 6513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resilient wall base, resilient flooring accessories, and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

C. Samples for Verification Purposes: In manufacturer's standard size, but not less than 12 in (300 mm) sample of each different color and pattern of resilient product specified, showing the full range of variations expected in these characteristics.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: Class I, 0.45 W/sq. cm or greater when tested per ASTM E 648.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

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 product manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.7 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless otherwise recommended by product manufacturer.

B. Maintain resilient products prior to installation at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during installation and for time period after installation recommended by manufacturer.

D. Install resilient products after other finishing operations, including painting, have been completed.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Selections: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 RESILIENT MATERIALS

A. Rubber Wall Base:

1. Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic), Group 1 and 2.
2. Thickness: Nominal 1/8 in (3 mm).
3. Lengths: Provide longest length(s) available per manufacturer. Provide coils if available in profile(s) indicated.
4. Outside and Inside Corners:

a. Job-formed.

B. Resilient Molding Accessories:

1. Carpeting Accessories: Carpet cove cap, carpet step-off, carpet reducer, carpet edge bar.
2. Resilient Flooring Accessories: Reducer strip and others as required.
3. Material: Rubber.
4. Lengths: Provide longest length(s) available per manufacturer. Provide coils if available in profile(s) indicated.
5. Color and finish as selected by Architect from manufacturer's standard colors.

2.4 ACCESSORY MATERIALS

A. Adhesives: Water-resistant type recommended by product manufacturer suitable for products, applications, and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION OF RESILIENT WALL BASE

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. Masonry Wall Surfaces: On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Job-Formed Corners: Use straight pieces of maximum lengths possible.

1. Outside Corners: Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: 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.

3.5 INSTALLATION OF RESILIENT FLOORING ACCESSORIES

A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.6 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes from exposed surfaces using cleaner recommended by manufacturer.
2. Sweep or vacuum horizontal surfaces thoroughly.
3. Do not wash resilient products until after time period recommended by manufacturer.
4. Damp-mop surfaces to remove marks and soil.

B. Protect resilient products against mars, marks, indentations, and other 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 resilient product manufacturer.

END OF SECTION

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SECTION 09 7200

WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Wall coverings and supplementary items necessary for installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, installation instructions, and recommendations for maintenance.
2. Include data on physical characteristics, durability, fade resistance, and flame resistance characteristics.

B. Shop Drawings: Show location and extent of each wall covering type. Indicate seams and termination points.

C. Samples for Verification Purposes: Sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1. Full-width sample, not less than 36 in (900 mm) long, from dye lot used for the Work.
2. Submit sample with specified treatments applied for products specified.
3. Show complete pattern repeat where applicable.

D. Product Schedule: Use same designations indicated on the Finish Schedule and Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: As follows, per ASTM E 84:

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 or less.

B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

   a. Show typical components and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Do not install wall coverings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

B. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

C. Lighting: Do not install wall covering until a lighting level of not less than 15 foot-candles (160 lux) is provided on the surfaces to receive wall covering.

D. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the wall covering manufacturer for full drying or curing.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on product and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

   1. Manufacturer and Product: As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 WALL COVERING MATERIALS

A. Vinyl Wall Covering: Provide integrally pigmented, opaque virgin vinyl calendared film vinyl wall covering material treated with mildew and antimicrobial additives and laminated to suitable backing. Comply with FS CCC-W-408D, Type II (except where Type I is specifically scheduled), Class 1, and CFFA W-101-D.

2.4 ACCESSORY ITEMS

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

C. Comply with manufacturer's written instructions for surface preparation.

D. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, and dirt. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.

1. Prime new gypsum board with primer recommended by wall covering manufacturer.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

3.4 INSTALLATION OF WALL COVERINGS

A. Comply with wall coverings manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Cut wall covering panels in roll number sequence. Change run numbers at partition breaks and corners only.

C. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage. Install seams vertical and plumb at least 6 in (150 mm) from outside corners and 3 in (75 mm) from inside corners. No horizontal seams are permitted.

D. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

E. Trim edges for color uniformity, pattern match, and tight closure at seams and edges. Butt seams without any overlay or spacing between strips.

3.5 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces. Use cleaning methods recommended by the wall covering manufacturer.

B. Replace strips that cannot be cleaned.

C. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

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EL PASO, TEXAS

SECTION 09 9100

INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation and field painting of exposed interior items, and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where indicated that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels, unless indicated otherwise.

1. Prefinished items include the following factory-finished components:

a. Prefinished wood doors.
b. Acoustical materials.
c. Prefinished Architectural woodwork and cabinets.
d. Finished mechanical and electrical equipment.
e. Light fixtures.
f. Distribution cabinets.
g. Baked enamel coated items.
h. Fluoropolymer coated items.
i. Integral colored plaster.
j. Integral colored PVC.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.
c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.
f. Duct shafts.

3. Finished metal surfaces include the following:

a. Anodized aluminum.
b. Stainless steel.
c. Chromium plate.
d. Copper and copper alloys.
e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

a. Valve and damper operators.
b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

a. Embossed UL labels may be used and painted where acceptable to authority having jurisdiction

D. Related Sections:

1. Division 09 Section "Gypsum Board Assemblies" for surface preparation of gypsum board assemblies.

1.2 DEFINITIONS

A. MPI Gloss Levels: MPI Gloss and Sheen Standard values are measured per ASTM D523, Method D and are as follows:

1. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees.
2. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
3. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
4. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
5. Gloss Level 5: 35 to 70 units at 60 degrees.
6. Gloss Level 6: 70 to 85 units at 60 degrees.
7. Gloss Level 7: More than 85 units at 60 degrees.

B. Interior Painting: Generally includes surfaces located in conditioned spaces.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, installation instructions, and recommendations for maintenance.

B. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 in (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers Project Acceptance Document: Certification that products are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that warranty will be issued.

1. Certifications by manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.5 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" and "MPI Maintenance Repainting Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockup in the location and of the size indicated or, if not indicated, as directed by Architect.

a. Architect will select one surface to represent surfaces and conditions for application of each paint system.

1) Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
2) Other Items: Architect will designate items or areas required.
3) Demonstrate repair procedures for damaged surfaces.

b. Apply samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
c. Final approval of color selections will be based on benchmark samples.

1) If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 PROJECT CONDITIONS

A. Apply paints only when temperatures of surfaces to be painted and surrounding air are between minimum and maximum range recommended by manufacturer.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. Behr.
2. Benjamin Moore & Co.
3. Dunn-Edwards Corporation.
4. Kelly-Moore Paints.
5. PPG Paints.
6. Pratt & Lambert Paints.
7. Sherwin-Williams Company (The).

B. Color and Gloss: As scheduled or as indicated in Design Selections.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Source Limitations: Obtain block fillers and field applied primers for each coating system from the same manufacturer as the finish coats.

C. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to shop applicators to ensure use of compatible primers.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to the following, unless otherwise specified in this Section:

1. Respective manufacturer's written installation instructions.
2. Approved submittals.
3. Contract Documents.
4. MPI Architectural Painting Specification Manual" or "MPI Maintenance Repainting Manual", as applicable.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" and "MPI Maintenance Repainting Manual" applicable to substrates and paint systems indicated.

C. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates, unless expressly permitted by authorities having jurisdiction for labels intended to be painted.

D. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

E. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

1. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

1. Galvanized metal substrates shall not be chromate passivated. If galvanized metal is chromate passivated, provide surface preparation and primers recommended by manufacturer.

G. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

## 3.4 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items, equipment, and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items, equipment, or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
5. The number of coats and film thickness required are the same regardless of application method.
6. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

7. Omit primer over metal surfaces that have been shop primed and touchup painted.
8. Allow sufficient time between successive coats to permit proper drying.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat. Tint per manufacturer's technical data for each type of primer or undercoat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve total dry film thickness of the entire system as recommended by manufacturer.

3.5 MECHANICAL AND ELECTRICAL WORK PAINTING AND IDENTIFICATION

A. Painting of Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work to be done when exposed in the following locations:

1. Occupied Spaces.

B. Equipment includes, but is not limited to, the following:

1. Tanks that do not have factory-applied final finishes.
2. Equipment that is indicated to have a factory-primed finish for field painting.

C. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces. Paint with a flat, nonspecular black paint.

3.6 FIRE AND SMOKE BARRIER IDENTIFICATION

A. Fire and smoke resistant rated walls shall be effectively and permanently identified with signs, labels or stencils in a manner acceptable to authority having jurisdiction.

1. Identification shall be above decorative ceiling and in concealed spaces, on each segment of the wall and 6'-0" O.C. maximum on each side of wall.

3.7 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of paint materials with product requirements.

3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.8 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces to match approved samples.

3.9 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. High-Performance Architectural Latex System: MPI INT 5.1R.

a. Prime Coat: Quick-drying alkyd metal primer (shop primed), MPI #76.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.
d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.
e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140.
f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.
g. Gloss and Sheen: As scheduled or as indicated in Design Selections.

B. Galvanized-Metal Substrates:

1. High-Performance Architectural Latex System: MPI INT 5.3M.

a. Prime Coat: Waterborne galvanized-metal primer, MPI #134.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.
d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140.
f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.
g. Gloss and Sheen: As scheduled or as indicated in Design Selections.

C. Gypsum Board and Plaster (Gypsum and Portland Cement) Substrates:

1. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.

a. Prime Coat: Institutional low-odor/VOC primer/sealer, MPI 149.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.
d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), MPI #144.
e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.
f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), MPI #146.
g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.
h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), MPI #148.
i. Gloss and Sheen: As scheduled or as indicated in Design Selections.

2. Water-Based Epoxy Coating System: MPI INT 9.2F.

a. Prime Coat: Interior latex primer/sealer, MPI #50.
b. Intermediate Coat: Epoxy-Modified Latex, Interior, matching topcoat.
c. Topcoat: Epoxy-Modified Latex, Interior, semi-gloss (MPI Gloss Level 5), MPI #215.
d. Topcoat: Epoxy-Modified Latex, Interior, gloss (MPI Gloss Level 6), MPI #115.
e. Gloss and Sheen: As scheduled or as indicated in Design Selections.

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EL PASO, TEXAS

SECTION 10 2613

WALL AND CORNER GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Impact-resistant wall protection systems, wall and corner guards, and supplementary items necessary for installation. Section includes custom sheet wall protection and custom door frame protection.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, physical characteristics such as durability, resistance to fading, and flame resistance, construction details, installation instructions, and recommendations for maintenance

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work

C. Plastic Samples for Verification Purposes: Submit for following products showing full range of color and texture variations expected in each wall protection system component:

1. Wall and Door Guards: 12 in (300 mm) long samples of each type of component indicated; include examples of joinery, corners, and field splices.
2. Corner Guards: 12 in (300 mm) long samples of each type of component indicated; include examples of joinery.
3. Wall Protection: 12 in (300 mm) square samples of each wall protection system component required with 6 inch long samples of moldings and trims.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: Include for each wall protection system component to include in maintenance manuals specified in Division 1. Include recommended methods and frequency for maintaining optimum condition of plastic covers under anticipated traffic and use conditions, and precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.4 QUALITY ASSURANCE

A. Mockups: Provide a benchmark sample. Install custom wall protection and custom door protection in first area of completed construction. After material is accepted, it can become part of the finished work.

B. Fire-Test-Response Characteristics: Provide wall protection system components with surface-burning characteristics indicated, as determined by testing identical materials according to ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify wall protection system components with appropriate markings of applicable testing and inspecting agency.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. Alpar Architectural Products.
2. American Floor Products Co., Inc.
3. Arden Architectural Specialties, Inc.
4. Construction Specialties, Inc. (C/S Group)
5. IPC Door and Wall Protection Systems; Division of InPro Corporation.
6. Korogard Wall Protection Systems; a division of RJF International Corporation.
7. Pawling Corporation.
8. Tepromark International, Inc.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 MATERIALS

A. Engineered PETG (Polyethylene Terepthalate Glycol) Material: Textured, chemical- and stain-resistant, high-impact-resistant co-polymer plastic with integral color throughout; PVC-free with no PBTs or BPA, extruded and sheet material, thickness as indicated.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. (1356 J/m) of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested according to ASTM D 543 or ASTM D 1308.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.
6. Color and Texture: As scheduled or as indicated in Design Selections.

B. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer.

2.4 WALL AND CORNER GUARDS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturers and Products: As scheduled or as indicated in Design Selections.

2.5 FABRICATION

A. General Requirements: Fabricate wall protection system components to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including thicknesses of components.

1. Preassemble components in shop to greatest extent possible to minimize field assembly.
2. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 EXAMINATION

A. Acceptance of Conditions: Examine substrate surfaces to which wall protection system components will be installed for compliance with requirements, installation tolerances and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance.

3.5 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

a. Provide anchoring devices to withstand imposed loads.
b. Where splices occur in horizontal runs of more than 20 ft (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 in (300 mm).
c. Adjust end and top caps as required to ensure tight seams.

B. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.6 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

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# SECTION 10 2813

# TOILET ACCESSORIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Toilet accessories and supplementary items necessary for installation.

### 1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, dimensions, and profiles of individual components.
2. Include details for cutouts required in other Work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

### 1.3 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For inclusion in operation and maintenance manual as required by Division 01 Section "Operation and Maintenance Data". Include manufacturer's instructions for maintenance of installed Work, including methods and frequency for maintaining optimum condition under anticipated use. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

### 1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.6 COORDINATION

A. Coordinate installation of products with interfacing and adjoining construction to provide a successful installation without failure.

1.7 WARRANTY

A. Mirror Manufacturer's Warranty: Furnish warranty for a period of 15 years from date of Substantial Completion agreeing to replace mirrors that develop visible silver spoilage defects, signed by an authorized representative using manufacturer's standard form.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corp.
5. Brey Krause Manufacturing.
6. GAMCO, a Division of Bobrick.

B. Basis of Design: Contract Documents are based on products specified to establish a standard of quality. Other manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and do not change intended aesthetic, functional and performance requirements as judged by Architect.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. General Requirements:

1. Unless otherwise indicated, fabricate units of all-welded construction, with corners and returns as indicated, tight seams and joints, and exposed edges rolled.
2. Fabricate frames drawn and leveled, one-piece seamless construction.
3. Hang doors and access panels with full-length, stainless-steel hinges.
4. Equip units for concealed anchorage and with corrosion-resistant backing plates.

C. Manufacturer Names or Labels: Not permitted on exposed faces of accessories. Provide printed label or stamped metal nameplate indicating manufacturer's name and product model number on an easily noticeable interior surface or on back surface of each accessory.

D. Keys: Provide minimum of 6 universal keys for internal access to accessories for servicing and resupplying.

E. Accessibility Requirements: Products and installation shall comply with Americans with Disabilities Act (ADA), ANSI A 117.1, and state and local accessibility standards.

2.3 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 satin finish; minimum 0.0312 in (0.8 mm) (22 gage) nominal thickness unless otherwise indicated.

B. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 1/4 in (6 mm) thick, with silvering, electroplated copper coating, and protective organic coating.

C. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

D. ABS Plastic: Moldable acrylonitrile-butadiene-styrene resin formulation.

E. HDPE Plastic: Moldable high-density polyethylene resin formulation.

F. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of non-corrosive metal when concealed.

H. Sealant: Silicone mildew resistant sealant specified in Division 07 Section "Joint Sealants".

2.4 TOILET TISSUE DISPENSERS

A. Drawing Designation B9 - Owner Furnished Toilet Tissue Dispenser: Refer to Division 01 Sections "Summary" and "Execution" for general requirements.

2.5 WASTE RECEPTACLES

A. Drawing Designation C4 - Owner Furnished Free Standing Waste Receptacle: Refer to Division 01 Sections "Summary" and "Execution" for general requirements.

2.6 TOWEL DISPENSER

A. Drawing Designation D4 - Owner Furnished Paper Towel Dispenser: Refer to Division 01 Sections "Summary" and "Execution" for general requirements.

2.7 GRAB BARS

A. Drawing Designation E1, E2, E3, E4, E5, E15 - Straight Surface-Mounted Satin Finish Grab Bar with Slip-Resistant Gripping Surface:

1. Description: Fabricated of stainless steel tube; with minimum 0.050 in (1.25 mm) (18 gage) wall thickness and 1-1/2 in (38 mm) outside diameter, with 1-1/2 in (38 mm) clearance between wall surface and inside face of bar.

a. Gripping Surfaces: Satin texture with peened gripping surfaces.
b. Shapes: Either as indicated, or as required by condition requiring grab bar.
c. Mounting: Concealed flanged steel plate welded to end of bar, as required by mounting condition, with snap-on cover; engineered to support minimum 300 lbs (136 kg).

2. Basis of Design:

a. E1: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 12; 12 in (300 mm).
b. E2: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 18; 18 in (450 mm).
c. E3: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 24; 24 in (600 mm).
d. E4: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 36 36 in (900 mm).
e. E5: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 42; 42 in (1050 mm).
f. E15: Bobrick Washroom Equipment, Inc. Model B-6806.99 x 18; 18 in (450 mm).

B. Drawing Designation E7 - Configured Surface-Mounted Satin Finish Grab Bar with Slip-Resistant Gripping Surface:

1. Description: Fabricated of stainless steel tube; with minimum 0.050 in (1.25 mm) (18 gage) wall thickness and 1-1/2 in (38 mm) outside diameter, with 1-1/2 in (38 mm) clearance between wall surface and inside face of bar.

a. Gripping Surfaces: Satin texture with peened gripping surfaces.
b. Shapes: Either as indicated, or as required by condition requiring the grab bar.
c. Mounting: Concealed flanged steel plate welded to end of bar, as required by mounting condition, with snap-on cover; engineered to support minimum 300 lbs (136 kg).

2. Basis of Design:

a. E7: Bobrick Washroom Equipment, Inc. Model B-6861.99 16 in x 31 in (400 mm x 775 mm) unit.

2.8 SOAP DISPENSERS

A. Drawing Designation J4 & Z1 - Owner Furnished Soap & Foam Dispenser: Refer to Division 01 Sections "Summary" and "Execution" for general requirements.

2.9 FOLDING SHOWER SEATS

A. Drawing Designation N1 - Surface-Mounted Folding Shower Seat:

1. Description: Fabricated of stainless steel minimum 0.0625 in (1.6 mm) (16 gage) square tubing and with 0.050 in (1.25 mm) (18 gage) round tubing; reversible L-shaped hinged seat made of phenolic or polymeric composite of either slat type or one-piece construction, with support braces, hinges, and frame designed to fold up against wall when not in use; color as selected by Architect from selections available. Shower seat shall comply with barrier-free accessibility guidelines.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-5181.

B. Drawing Designation N2 - Surface-Mounted Folding Shower Seat:

1. Description: Fabricated of stainless steel minimum 0.0625 in (1.6 mm) (16 gage) square tubing and with 0.050 in (1.25 mm) (18 gage) round tubing; one piece, rectangular-shaped hinged seat made of phenolic or polymeric composite of either slat type or one-piece construction, with support braces, hinges, and frame designed to fold up against wall when not in use; color as selected by Architect from selections available. Shower seat shall comply with barrier-free accessibility guidelines.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-5193.

2.10 MOP AND BROOM HOLDERS

A. Drawing Designation P1 - Surface-Mounted Mop and Broom Holder with Utility Shelf:

1. Description: Fabricated of stainless steel, minimum 0.050 in (1.25 mm) (18 gage) thick shelf with returned edges, and support brackets for wall mounting; with three 0.0625 in (1.6 mm) (16 gage) stainless steel rag hooks on front of shelf, together with four spring-loaded, rubber hat, cam-type mop/broom holders; 1/4 in (6 mm) diameter stainless steel drying rod suspended beneath shelf; 36 in (900 mm) long.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-224 X 36.

2.11 CHILD CARE PRODUCTS

A. Drawing Designation Q1 - Owner Furnished Surface-Mounted Diaper Changing Station: Refer to Division 01 Sections "Summary" and "Execution" for general requirements.

2.12 MIRRORS

A. Drawing Designation R1 - Surface-Mounted Stainless Steel Framed Mirror (without Shelf):

1. Description: Fabricated of stainless steel; exposed frame with angle shapes not less than 0.050 in (1.25 mm) (18 gage) thick, with square corners mitered, welded, and ground smooth, and to accommodate glass edge protection material; with galvanized steel backing sheet, minimum 0.034 in (0.8 mm) (22 gage) in thick and full mirror size, with non-absorptive filler material (corrugated cardboard not acceptable), and with hanging brackets; glass mirror.
2. Basis of Design: Bobrick Washroom Equipment, Inc. Model B-290 2436.

2.13 ROBE HOOKS

A. Drawing Designation V1 - Owner Furnished Surface-Mounted Robe Hook: Refer to Division 01 Sections "Summary" and "Execution" for general requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, install toilet accessories according to the following, unless otherwise specified in this Section:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. General Requirements: Install toilet accessories level, plumb, and firmly anchored in locations and at heights indicated. Use fasteners that are appropriate to substrate indicated and as recommended by respective product manufacturer.

B. Grab Bars: Install to withstand downward load of minimum 250 lbf (1.10 kN) according to ASTM F 446.

C. Accessories within Shower and Tub Alcoves: Set flanges of accessories in sealant, install sealant in screw holes prior setting screws, and cover screw head prior to snapping on cover, to prevent water infiltration.

D. Mirrors: Secure to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws.

END OF SECTION

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 10 4400

FIRE-PROTECTION SPECIALTIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Work required for this section includes fire protection specialties (fire extinguishers, cabinets, accessories) and supplementary items necessary to complete their installation.

B. Cabinets for fire protection standpipe and hose systems are specified in Division 21.

### 1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Fire Extinguishers: Include rating and classification.
3. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

### 1.3 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

### 1.4 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

### 1.5 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. J. L. Industries, Inc.; a division of Activar Construction Products Group.
2. Larsen's Manufacturing Company.
3. Potter Roemer LLC.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 1008/A 1008M, commercial quality, stretcher leveled, temper rolled.

2.4 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Multipurpose Dry Chemical Type; typical unless otherwise indicated or specified: UL-rated 2A:10B:C, 5-lb nominal capacity, in enameled steel container.

2.5 FIRE-PROTECTION CABINETS

A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

B. Cabinet:

1. Material:

a. Steel sheet.

2. Type: Suitable for 10 lb. Fire extinguisher.
3. Mounting:

a. Recessed: Recess cabinets in walls of sufficient depth to suit style of trim indicated.
b. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

4. Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth. Same metal and finish as door.

a. 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).

1) Flat Trim: 1/4 in (6 mm) to 5/16 in (8 mm) backbend depth.
2) Square-Edge Trim: 1-1/4 in (32 mm) to 1-1/2 in (38 mm) backbend depth.

5. Door Material:

   a. Steel sheet.

6. Door Style: Manufacturer's standard smooth front.
7. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected. Provide minimum 1/2 in (12mm) thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.
8. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.6 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish. Provide brackets for extinguishers not located in cabinets.

B. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.

   1. Bracket-Mounted Extinguishers: Identify with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.
   2. Fire Extinguisher Cabinet: Identify with the words "FIRE EXTINGUISHER" in red die cut vinyl letters applied to door.

2.7 GENERAL FINISH REQUIREMENTS, FIRE-PROTECTION CABINETS

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

2.8 STEEL FINISHES, FIRE-PROTECTION CABINETS

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

1. Color and Gloss: Match existing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

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

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
2. Fasten cabinets to structure, square and plumb.

3.5 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

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8TH FLOOR TENANT IMPROVEMENT
EL PASO, TEXAS

SECTION 10 5113

METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work required for this Section includes metal lockers and supplementary items necessary to complete their installation.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance for each type of locker and bench.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work

1. Show locker fillers, trim, base, tops, and accessories. Include locker-numbering sequence.

C. Samples for Verification: For each locker color selected, in manufacturer's standard size samples, but not less than 4 inch square, showing the full range of color, texture, and pattern variations expected. Prepare Samples from the same material to be used for the Work.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals specified in Division 01.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Unless otherwise indicated, at least 5 percent but no less than one of each type of lockers shall comply with accessibility requirements, of the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG).

1. Provide not less than one shelf located within required reach ranges.
2. Provide hardware that does not require tight grasping, pinching, or twisting of the wrist, and that operates with a force of not more than 5 lbf.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

1. Art Metal Products; Standard K.D. Lockers.
2. ASI Storage Solutions Inc.; Traditional Collection.
3. DeBourgh Mfg. Co.; Worley Lockers.
4. List Industries Inc.; Classic Line of Superior KD Lockers.
5. Lyon Workspace Products, LLC; Standard Lockers.
6. Penco Products, Inc.; Vanguard Lockers.
7. Republic Storage Systems Company; Standard Lockers.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 366, matte finish, suitable for exposed applications, and stretcher leveled or roller leveled to stretcher-leveled flatness.

B. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.

2.4 WARDROBE LOCKERS

A. Body: Form backs, tops, bottoms, sides, and intermediate partitions from 0.0239 inch (24 gage) minimum steel sheet; flanged for double thickness at back vertical corners.

B. Frames: Form channel frames from minimum 0.0598-inch- thick steel sheet; lapped and welded at corners. Form continuous integral door strike on vertical frame members. Provide resilient bumpers to cushion door closing.

1. Latch Hooks: Form from minimum 0.1046-inch- thick steel; welded or riveted to door frames.
2. Cross Frames for Multi-Tier Lockers: Form intermediate channel cross frames between tiers from minimum 0.0598-inch- (1.50-mm-) thick steel sheet. Weld to vertical frame members.

C. Doors: One-piece 0.0598 inch (16 gage) minimum steel sheet, formed into channel shape at vertical edges and flanged at right angles at top and bottom edges. Fabricate to prevent springing when opening or closing, and to swing 180 degrees.

1. Reinforcement: Brace or reinforce inner face of doors more than 15 inches wide.
2. Acoustical Treatment: Fabricate lockers for quiet operation with manufacturer's standard rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact.
3. Louvered Vents: Stamped, louvered vents in door face, as follows:

a. Single-Tier Lockers: No fewer than six louver openings at top and bottom.
b. Double-Tier Lockers: No fewer than three louver openings at top and bottom.
c. Multiple-Tier Lockers: No fewer than two louver openings at top and bottom, or three louver openings at top or bottom.

D. Shelves: Provide hat shelf in single-tier units; fabricated from minimum 0.0239-inch- thick, formed steel sheet; flanged on all edges.

E. Hinges: Steel, full loop, five or seven knuckle; tight pin; minimum 2 inches high. Weld to inside of door frame and attach to door with at least two factory-installed fasteners that are completely concealed and tamper resistant when door is closed.

1. Provide at least three hinges for each door more than 42 inches high and at least two hinges for each door 42 inches high or less.

F. Recessed Handle and Latch: Manufacturer's standard housing, formed from 0.0359-inch-thick nickel-plated steel or stainless steel, with integral door pull, recessed for latch lifter and locking devices; nonprotruding latch lifter; and automatic, prelocking, pry-resistant latch, as follows:

1. Provide minimum three-point latching for each door more than 42 inches high; minimum two-point latching for each door 42 inches high or less.

a. Provide strike and eye for padlock.

2.5 LOCKER ACCESSORIES

A. Interior Equipment: Furnish each locker with the following items, unless otherwise indicated:

1. Hooks: Manufacturer's standard zinc-plated, ball-pointed steel. Provide one double-prong ceiling hook, and not fewer than two single-prong wall hooks for single-, double-, and triple-tier units. Attach hooks with at least two fasteners.
2. Coat Rods: Manufacturer's standard galvanized steel. Provide rod in lieu of ceiling hook for lockers 18 inches deep or greater.

B. Number Plates: Manufacturer's standard etched, embossed, or stamped, aluminum number plates with numerals at least 3/8 inch high. Number lockers in sequence indicated. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

C. Continuous Metal Base: Minimum 0.0598-inch- (16 gage) thick steel sheet, 6 inch high channel or zee profiled for stiffness, fabricated in lengths as long as practicable to enclose base and base ends of lockers, and finished to match lockers.

D. Continuously Sloping Tops for Non-Recessed Units: Manufacturer's standard, fabricated from minimum 0.0359-inch- (20 gage) thick steel sheet, for installation over lockers with separate flat tops. Fabricate tops in lengths as long as practicable, without visible fasteners at splice locations, finished to match lockers. Provide fasteners, filler plates, supports, and vertical end closures.

E. Recess Trim for Recessed Units: Manufacturer's standard; fabricated from minimum 0.0478-inch- (18 gage) thick steel sheet, minimum 2-1/2-inch face width, and finished to match lockers. Fabricate trim in lengths as long as practicable.

F. Filler Panels: Manufacturer's standard; fabricated from minimum 0.0478-inch- (18 gage) thick steel sheet in an unequal leg angle shape, and finished to match lockers. Provide slip joint filler angle formed to receive filler panel.

G. Finished End Panels for Non-Recessed Units: Manufacturer's standard; fabricated from minimum 0.0239-inch- (24 gage) thick steel sheet, finished to match lockers, and designed for concealing exposed ends of nonrecessed lockers.

2.6 FABRICATION

A. Unit Principle: Fabricate each locker with an individual door and frame, individual top, bottom, back, and shelves, and common intermediate uprights separating compartments.

B. Knocked-Down Construction: Fabricate lockers for nominal assembly at Project site.

C. Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch. Weld frame members together to form a rigid, one-piece assembly.

1. Form locker-body panels, doors, shelves and accessories from one-piece steel sheet, unless otherwise indicated.

2.7 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.

2.8 STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-enamel finish consisting of a thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 1.4 mils on doors, frames, and legs, and 1.1 mils elsewhere.

1. Color and Gloss: As scheduled or as indicated in Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Install metal lockers and accessories level, plumb, rigid, and flush according to manufacturer's written instructions.

B. Assemble knocked-down lockers with standard fasteners, with no exposed fasteners on door faces and face frames.

C. Anchor lockers to floors and walls at intervals recommended by manufacturer, but not more than 36 inches o.c. Install anchors through backup reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.

D. Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Recessed Units:

a. Attach recess trim to recessed lockers with concealed clips.

2. Non-Recessed Units:

   a. Attach sloping top units to lockers, with closures at exposed ends.
   b. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of non-recessed lockers.

3.5 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Clean interior and exposed exterior surfaces and polish stainless-steel and nonferrous-metal surfaces.

C. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.

D. Touch up marred finishes, or replace locker units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

3.6 LOCKER SCHEDULE

A. Refer to the drawings.

3.7 FINISH SCHEDULE

A. Locker Color and Gloss: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

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EL PASO, TEXAS

SECTION 11 3000

AUDIO-VISUAL MOUNTING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mounting brackets and accessories.

1.2 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings: Provide Plan, section, elevation and perspective drawings as necessary to depict actual dimensions and appropriate attachment procedures. Coordinate locations with those found on the Construction Drawings.

C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten (10) years experience.

B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.5 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.

1.6 WARRANTY

A. At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Chief Manufacturing Inc., which is located at: 8401 Eagle Creek Pkwy. ; Savage, MN 55419 ; Toll Free Tel: 800-582-6480 USA; 877-345-4329; Tel: 952-894-6280; Email: request info (chief@chiefmfg.com); Web: www.chiefmfg.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 2500.

2.2 PROJECTOR MOUNTS

A. Fixed Mounts:

1. As selected.

2.3 MOUNT ACCESSORIES

A. Mount Accessories:

1. Wii U-wall mounting bracket.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

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. Install in accordance with manufacturer's instructions.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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EL PASO, TEXAS

SECTION 11 7000

MEDICAL EQUIPMENT

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Work of this Section includes related wall support, mechanical and electrical connections for medical equipment provided by Owner.

B. Medical equipment information at the end of this Section is for reference only.

### 1.2 ACTION SUBMITTALS

A. Product Data: Furnished by Owner.

B. Shop Drawings: Contractor shall furnish shop drawings of equipment installation when necessary to ensure coordination of the Work.

## PART 2 - PRODUCTS

### 2.1 OWNER FURNISHED / OWNER INSTALLED EQUIPMENT

A. Products: Identified as "OFOI". Product is provided by Owner and installed by Owner.

B. Contractor Responsibilities: Limited to interface, surface preparations and utilities indicated on the Drawings or specified in the Specifications.

### 2.2 OWNER FURNISHED / CONTRACTOR INSTALLED EQUIPMENT

A. Products: Identified as "OFCI". Product is provided by Owner and installed by the Contractor.

B. Contractor Responsibilities: Provide labor, transportation, materials, tools, appliances and utilities necessary for the following:

1. Transportation of product from Owner's facility to the job site.
2. Receiving and storage of product.
3. Installation of product, complete and in operating condition, including adjusting and calibration of product as necessary for proper operation.
4. Testing of product.
5. Paying of fees, licenses, and taxes in conjunction with installation of the product.
6. Roughing-in and final utility connections for product remain the work of specification sections governing the specific utility.

### 2.3 CONTRACTOR FURNISHED / CONTRACTOR INSTALLED EQUIPMENT

A. Products: Identified as "CFCI". Product is provided by Contractor and installed by Contractor.

B. Contractor Responsibilities: Furnish equipment and installation as indicated in other specification sections.

2.4 OWNER FURNISHED / VENDOR INSTALLED EQUIPMENT

A. Products: Identified as "OFVI". Product provided by Owner, and installed by Owner's vendor.

B. Contractor Responsibilities: Limited to interface, surface preparations and utilities indicated on the Drawings or specified in the Specifications.

2.5 FUTURE EQUIPMENT

A. Products: Identified as "Future". Product provided by Owner and installed by others in the future.

B. Contractor Responsibilities: Limited to interface, surface preparations and utilities indicated on the Drawings or specified in the Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. For Contractor installed medical equipment, examine substrate surfaces to receive medical equipment and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 PREPARATION

A. Coordinate work of this Section with related work of other Sections to obtain proper installation of items. Become acquainted with the work of other Sections whose work abut, adjoin or are in any way affected by or related to work under this Section.

B. Carefully examine the drawings and directions and be responsible for proper installation of materials and product without substantial changes.

C. Indication of pipe connection sizes on the plans shall in no way relieve Contractor of the responsibility of checking and verifying their sizes and locations from the actual product to be installed and any available roughing-in diagrams.

3.3 SCOPE OF WORK

A. Back-up Support: Provide wall reinforcing, backing and bracing for wall mounted equipment.

B. Concrete: Provide work indicated or required including, but not limited to, the following:

1. Housekeeping pads.
2. Trenches.
3. Anchor bolts.
4. Vibration isolation devices.

5. Core drilling.
6. Sleeves.

C. Heating, Ventilating, and Air Conditioning (HVAC): Provide work indicated or required including, but not limited to, exhaust ducts from connection point of equipment to building exhaust system.

D. Plumbing: Provide work indicated or required, including, but not limited to, the following:

1. Devices such as vacuum breakers, pressure reducing valves, shut-off valves, trim, traps, filters, etc.
2. Water, waste, gas, air, and steam connections to equipment.

E. Electrical: Provide work indicated or required including, but not limited to, the following:

1. Wiring and devices.
2. Power and lighting service.
3. Connections to equipment.

3.4 SCHEDULE OF MEDICAL EQUIPMENT

A. Refer to separately bound document.

END OF SECTION

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EL PASO, TEXAS

SECTION 12 2413

ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Roller window shades and supplementary items necessary to complete their installation.

1. Manually operated roller shades.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include styles, material descriptions, construction details, 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.

C. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 in (250 mm) square. Mark inside face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 in (400 mm) wide by 36 in (900 mm) long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 in (250 mm) long.

D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1. Methods for maintaining roller window shades and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.

3. Operating hardware.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

B. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.7 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.

1.8 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 products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Coverage of warranty includes but is not limited to the following:

a. Fabric failure includes deterioration, sag, warp, fade or will not remain fit for use.

2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for the following periods from date of Substantial Completion

a. Manual operating components: 10 years.
b. Shade Cloth: 10 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer and Product: As scheduled or as indicated in Design Selections, to match existing.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 MANUALLY OPERATED SHADES

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard, Stainless steel.

a. Loop Length: Full length of roller shade, unless otherwise indicated.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Clip, Chain tensioner and mounting as selected by Architect.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.

    a. Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criteria are more stringent.

B. Rollers - Single: 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: As indicated on Drawings.
2. Direction of Shadeband Roll: Regular, from back of roller, unless otherwise indicated.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Rollers - Double: 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. Double-Roller Mounting Configuration: Offset, outside roller over and inside roller under, unless otherwise indicated.
2. Inside Roller:

    a. Drive-End Location: As indicated on Drawings.
    b. Direction of Shadeband Roll: Regular, from back of roller.

3. Outside Roller:

    a. Drive-End Location: As indicated on Drawings.
    b. Direction of Shadeband Roll: Reverse, from front of roller

4. Shadeband-to-Roller Attachment: Manufacturer's standard method.

2.4 SHADEBANDS AND ACCESSORIES

A. Shadebands - Single Roller:

1. Shadeband Material: Refer to Shade Schedule for type. Color as scheduled or as indicated in Design Selections.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material, unless otherwise indicated.
    b. Color and Finish: As selected by Architect from manufacturer's full range.

B. Inside Shadebands - Double Roller:

1. Shadeband Material: Refer to Shade Schedule for type. Color as scheduled or indicated in Design Selections.
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

C. Outside Shadebands - Double Roller:

1. Shadeband Material: Refer to Shade Schedule for type. Color as scheduled or indicated in Design Selections.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Exposed with endcaps and integral light seal with bottom (sill) channels.
b. Color and Finish: As selected by Architect from manufacturer's full range.

D. Installation Accessories:
1. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.

a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 6 in (150 mm)
b. Provide pocket with lip at lower edge to support acoustical ceiling panel.

2. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
3. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

E. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.

F. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

2.5 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. Shade Band Material: Manufacturer's standard PVC-free shade band material.

2.6 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 (23 deg C):

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 in (6 mm) per side or 1/2 in (12 mm) total, plus or minus 1/8 in (3 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 in (6 mm), plus or minus 1/8 in (3 mm).
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

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. Obtain approved locations from Architect prior to fabrication.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

### 3.2 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

### 3.3 ROLLER-SHADE INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. 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 in (50 mm) to interior face of glass. Allow clearances for window operation hardware.

3.4 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.5 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.

END OF SECTION

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EL PASO, TEXAS

SECTION 12 3661

SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The following simulated stone countertops along with supplementary items necessary for installation:

1. Solid surfacing countertops.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Show locations and sizes of cutouts and holes for plumbing fixtures, accessories and other items installed in countertops.

C. Samples for Verification Purposes: For simulated stone material, 6 in (150 mm) square, showing color and pattern selected.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.

B. Fire-Test-Response Characteristics: Provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.8 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Color(s): As scheduled or as indicated in Design Selections.

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer/fabricator. Provide secondary materials only as recommended by manufacturer/fabricator of primary materials.

2.3 SIMULATED STONE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogenous solid sheets of filled plastic resin complying with ANSI SS1.

B. Panel Thickness: Minimum 1/2 in (12 mm) or as indicated on drawings.

2.4 ACCESSORIES

A. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded and other requirements as specified in Division 06 Section "Miscellaneous Rough Carpentry".

B. Adhesives: Manufacturers recommended adhesive.

C. Lavatory Bowls: Provide one or both types below, as indicated on drawings:

1. Integral Lavatory Bowl (Rectangular): Made of solid surfacing material; nominal 15 in (375 mm) front-to-back by 20 in (500 mm) side-to-side inside plan dimension by 5 in (125 mm) deep; drain 4 in (100 mm) from rear side, provide unit with overflow; seam-mount installation.

   a. Manufacturer and Product: Gemstones Sinks; model 1812-UVO.

2. Integral Lavatory Bowl (Oval): Made of solid surfacing material; 13 in (330 mm) front-to-back by 16-1/2 in (419 mm) side-to-side inside plan dimension by 5-1/2 in (140 mm) deep; drain 4-1/8 in (104 mm) from rear side, provide unit with side overflow; seam-mount installation.

   a. Manufacturer and Product: Dupont; Corian 810P with side overflow.

3. Under-slung or Self-Rimming Lavatory Bowls: Where indicated, provide as specified in Division 22 Plumbing Sections.

D. Backsplash: Preformed 4 in (100 mm) high coved backsplash, to match countertop.

E. Front Edge Trim: Preformed 1-1/2 in (38 mm), to match countertops.

F. Accessories: Provide joint seam adhesives and other items required for a complete installation as recommended in writing by simulated stone manufacturer.

G. Sealant: Mildew resistant silicone sealant as specified in Division 07 Section "Joint Sealants".

2.5 FABRICATION OF SIMULATED STONE COUNTERTOPS

A. Accurately cut holes and drill countertop panels to receive plumbing, fixtures, soap dispensers and other accessories. Obtain field measurements prior to fabrication and maintain minimum clearance at walls.

B. Fabricate tops in one piece with shop-applied backsplashes and edges, unless otherwise indicated. Comply with simulated stone manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

### 3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

### 3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

### 3.4 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/16 in per 48 in (1.5 mm per 1200 mm).

B. Variation from Level: Do not exceed 1/8 in per 96 in (3 mm per 2400 mm), 1/4 in (6 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/4 of nominal joint width.

D. Variation in Plane at Joints (Lipping): Do not exceed 1/64 in (0.4 mm) difference between planes of adjacent units.

E. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64 in (0.4 mm) difference between edges of adjacent units, where edge line continues across joint.

### 3.5 INSTALLATION OF SIMULATED STONE COUNTERTOPS

A. Install countertops over plywood sub-tops secured to sub-framing supports with full spread of silicone adhesive in accordance with manufacturer's recommendations.

B. Set countertops to comply with requirements indicated on Drawings and Shop Drawings. Shim and adjust to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.

C. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.

D. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Secure backsplashes to tops and walls with adhesive.

F. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants".

G. Prepare ends and edges of simulated stone pieces to be joined according to the manufacturer's/fabricator's recommendations for position and angle of butted joint. Lightly sand and thoroughly clean to remove dirt and grease. Join pieces with adhesive clamped until fully cured. Buff and sand to produce a smooth uniform seamless surface.

H. Apply sealant and compress to form bond with simulated stone material and adjacent surfaces and tool sealant surface to clean, straight lines.

3.6 CLEANING

A. Promptly clean simulated stone as work progresses to minimize final cleaning. Do not leave adhesive or sealant to dry on simulated stone faces.

B. Final clean and protect installed countertops in accordance with manufacturer's instructions.

END OF SECTION

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# SECTION 14 9200

# PNEUMATIC TUBE SYSTEM

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Pneumatic tube systems and supplementary items necessary for installation.

### 1.2 DELEGATED DESIGN REQUIREMENTS

A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required and shall not be construed as an engineered design. Furnish and install all Work required for a complete installation.

B. Coordination of Contract Documents and Work:

1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturer, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.
2. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

### 1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Show tube routings on architectural floor plans, tubing riser diagram, electrical riser diagram, right-of-way, methods of suspending and anchoring tubing, station details, equipment locations and detailed dimensions of all major components.

1.4 INFORMATIONAL SUBMITTALS

A. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

B. Warranty:

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Record Documents: Provide, as record documents, as-built shop drawings in a format acceptable to the Owner for instruction and future reference by the Owner.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

1.7 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.10 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 2 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures"

1. Pevco Systems International
2. Aerocom Systems, Inc.
3. Air Link International
4. Swisslog

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PNEUMATIC TUBE SYSTEM

A. System Description: Computer controlled pneumatic tube materials distribution system consisting of tubing, stations, transfer units, blower packages, carriers and a control center.

1. Configured of groups of stations (zones) connected together by interzone tubes. Each station shall be connected to the pneumatic tube system by a single tube to a transfer unit.
2. Each zone shall include a blower and function independently.

3. Dispatching, routing, and storage of carriers shall be directed by system control center (SSC) to provide automatic unattended transmission of carriers between any two stations.
4. Provide shortest route vacuum-pressure travel. Transactions within a zone shall turn around at the nearest transfer unit common to the origin and destination stations.
5. To dispatch a carrier from a station, the operator shall place the latched carrier in the dispatcher, select the destination address and press the "Send" push-button at the station.
6. Pneumatic tube systems with more than one zone shall allow multiple carriers to be in transit simultaneously. Allow all station dispatchers to be loaded simultaneously, destinations to be selected and all transactions processed automatically until the pneumatic tube system is clear.
7. Pneumatic tube system shall consist of a quantity of stations as indicated on plans and arranged in a quantity of zones to be determined.
8. Modular design of the pneumatic tube system components shall permit changes in the number of stations and/or zones as Owner requirements change.
9. Provide automatic empty carrier redistribution. The pneumatic tube system shall enable operators to dispatch excess empty carriers to carrier-deficient stations which shall be automatically identified and selected by the pneumatic tube system. The need shall be determined by the ratio of carriers assigned to carriers present taking into account carriers in transit to the station, carriers queued for dispatch to the station and carriers queued for dispatch from the station.
10. Individual stations or zones shall be able to be shut down without affecting the remainder of pneumatic tube system.
11. Destinations which are unavailable (non-existing, full, out-of-service) shall be rejected at the origination station. Prior to dispatch the route to the destination station shall be checked twice to ensure that all sections of the pneumatic tube system involved in the transaction are operating properly.
12. A transaction to a station that becomes unavailable after dispatch shall be rerouted to the origin station.
13. Transactions in process or pending when any part of the pneumatic tube system is signed off shall deliver to their destinations. Any new requests to send shall be rejected.
14. If a power failure occurs, the pneumatic tube system will continue to process carriers under UPS power and an advisory will be posted at the system control center (SCC). If UPS voltage drops below a programmable threshold, a second message will be posted at the SCC monitor and the pneumatic tube system will automatically switch to Quick-off. All in-transit carriers will be processed to their destinations and all pending transactions will be cancelled.
15. If power fails at a blower, transfer unit or station, the controls will identify that device as unavailable voiding all transactions which involve the affected device.
16. Each station shall be able to be individually assigned up to ten scheduled events per day including; on/off times, send and receive priorities, carrier forwarding on/off and quantity of assigned carriers.
17. Station sending and receiving and pneumatic tube system priorities shall ensure that carriers are processed to their destinations in the shortest time.
18. Closed loop control shall verify via feedback loops that a command to a pneumatic tube system component is properly executed before the next segment of the transaction is initiated.
19. A 115 VAC duplex receptacle and device on/off switch shall be provided at each station, transfer unit and blower package.
20. The destinations available at each station shall be individually configurable at the system control center (SSC).

21. Stations shall be able to be individually scheduled to be able to dispatch but not receive carriers.
22. Each station, transfer unit, exchanger and blower shall include diagnostic capability at the unit.

2.4 COMPONENTS

A. Line Material: Tubing shall be 6" outside diameter, 16 gauge, cold rolled, electric welded steel, flash removed, degreased and hot dip galvanized.

1. Bends shall be formed of same material on a centerline radius of not less than 48 inches. The cross-section shall be free from wrinkles and distortions. No expanded bends shall be allowed in the System.
2. All cut ends shall be square, deburred and mandreled round.
3. Solid steel slip sleeves or split steel gasketed bolted sleeves shall be used for tubing joints. Split sleeves shall be used at all connections of serviceable equipment. All sleeves shall be of the same gage as the tubing.
4. Slip joints shall be sealed with a suitable airtight compound.
5. Tubing shall be supported with suitable hangers and supports as follows:

   a. Minimum every 10 feet of straight tubing,
   b. At every floor of vertical runs,
   c. At each end of each bend,
   d. At equipment connections, and
   e. At the center of the bend radius with sway bracing.

6. Hangers shall be pre-threaded, zinc plated rod attached to the building structure. Tube clamps or channels fastened to the rod shall support the tubing.

B. Transfer Units: Transfer units enable a transmission tube connection from one tube to any one of several tubes, providing the tubing network for routing carriers between stations.

1. Transfer units shall be installed with split sleeves and sway braced against motion.
2. Transfer units shall be located to allow for complete and clear access to service mechanical and electrical components.
3. The offset through the transfer unit shall be gradual using a curved tube section.
4. All transfer units component position sensing and carrier sensing shall be by non-contact sensors.
5. All visible metal surfaces shall be factory painted with an electrostatically applied, baked-on, powder coat epoxy.
6. Transfer units shall be provided as required in 1 to 2 ports, 1 to 4 ports and 1 to 6 ports.

C. Blower Packages: Blower units shall be modular factory assembled complete with integral vibration isolators, screen cleanout boxes and air shifting valves as required. Locate blowers to allow complete and clear access to service mechanical and electrical components.

1. Zone Blower Packages:

   a. One zone blower package shall be provided per zone.
   b. Zone blowers shall be the regenerative type.
   c. Zone blower packages shall be designed to be mounted above ceilings or on floors.

d. Zone blower packages located above ceilings where the sound level three feet below the ceiling must be less than 65 dB(A) shall be sound deadened with sound insulation and intake and exhaust mufflers.
e. Zone blowers shall be sized to provide vacuum and pressure in the tubing network to maintain nominal carrier speed of 20 fps.
f. For energy conservation blowers shall automatically shut down during low use periods.
g. Air tubing shall be 4" outside diameter of the same material as transmission tubing. Air tubing shall be of the same material as transmission tubing. Tubing shall be complete with all necessary tees, elbows and fittings.
h. All component position sensing shall be by non-contact switches.
i. All visible metal surfaces shall be factory painted with an electrostatically applied, baked-on, powder coat epoxy.

D. Stations: Stations shall consist of dispatch equipment; receive equipment and electrical controls enclosed in sheet metal housing.

1. Stations shall be up send, down receive.
2. All mechanical and electrical components shall be front accessible and removable for repair or replacement.
3. Electronic control units shall be solid-state plug-in type for fast replacement and shall be interchangeable with units in other stations.
4. All component position sensing and carrier sensing shall be by non-contact sensors.
5. All visible metal surfaces shall be factory painted with an electrostatically applied, baked-on, powder coat epoxy. Bright metal finish parts shall be stainless steel, brushed aluminum or chrome plated, as selected by Architect.
6. Dispatcher shall hold one carrier at a time.
7. Receiver shall be independent of the dispatcher.
8. Dispatcher shall enable a carrier to be staged for dispatch while a carrier is incoming to a station.
9. When station's receiver becomes full that stations receive and dispatch functions shall be disabled. A message on the station display and at the system control center shall indicate the full condition. The condition shall automatically reset upon carrier removal from receiver.
10. Stations shall provide air-cushioned carrier arrival at the receive slidegate.
11. Series Operator Control Panel: Each station shall be equipped with one modular operator control panel per dispatcher and shall include:

a. Membrane keypad for destination and special function selection.
b. Liquid crystal display with 48 characters for message display.
c. "Send/Enter" key to activate the dispatch after destination selection or to enter data for special functions.
d. "Cancel/Clear" key to allow for transaction cancellation or clearing of the display during special function activation.
e. "Special Function" key for selecting the following special features.

1) Stat Transaction
2) Secure Transaction
3) Transaction Tracking
4) Traffic Forwarding
5) Emergency Shutdown
6) Incoming Carrier Query
7) Station On/Off

8) Carrier Inventory Adjustment
9) Station Diagnostics
10) Audible Carrier Arrival
11) Audible Surplus Carriers
12) Audible Full Station

f. Directory of station addresses.
g. Instruction compartment for station operating instructions and special function instructions.
h. Discrete rejection messages to indicate:

1) Dispatching station off
2) Dispatching station not in service
3) Destination station full
4) Destination station does not exist
5) Destination station off
6) Destination station not in service
7) Selection is secured
8) Selection not permitted

i. LCD message capability for the following conditions:

1) Carrier is incoming to the station.
2) The station carrier count exceeds its assigned number, return surplus carriers.
3) The station is full, remove carriers from receiver.
4) The station is not receiving carriers; traffic is forwarded to another station.

E. Recessed Single Dispatcher Stations: Include one dispatch chamber and an integral receive bin. The receive bin shall provide open storage nominally for four carriers.

1. Station shall be designed to be wall recessed enabling all non-operator accessible equipment to be concealed behind walls. A trim frame shall be provided to conceal the joint between the wall and the station housing.
2. To minimize damage, stations shall be installed in two phases; housing in the initial stages of construction, and a mechanical/electrical finish kit after construction work in the area is substantially complete.
3. Recessed stations shall be located where indicated.

F. Carriers and Liners: Four standard carriers per station.

1. Clear molded plastic.
2. Full access side opening and self-latching upon closure.
3. Bi-directional.
4. Replaceable wear bands and latches.
5. Capable of carrying: specimens, medications, x-ray film, 1,000 ml IV bags filled up to 100 cc's.
6. Clear inside dimensions: 4-1/2" diameter by 15-5/8" length.

G. Low-Voltage Control Cable: Plenum-rated cables with minimum 18 gauge conductors. Cable shall be strapped to the transmission tubing at minimum 10' intervals.

H. System Control Center (SCC): Consist of a computer, monitor, keyboard, uninterruptible power supply, printer and software.

1. SSC shall direct all operations of the System and provide monitor display and hard copy feedback of the various System activities and data. Additions or changes to the System design such as station or transfer unit shall be accommodated without modifications to the system control center hardware.
2. SSC shall enable off-site monitoring, diagnostics and component actuation via control of the system control center through a telephone line link.
3. Software shall have the minimum capabilities:

a. Administration:

1) Enable users to log in or log out of system.
2) Assign one of four privilege levels for each user.
3) Download station directories.
4) Pin code list management.

b. System: Command on/off; per zone, entire system, orderly, urgent, clear.
c. Configuration:

1) Add, delete or modify a device.
2) View a device.
3) Set automatic schedules; on/off station/zone/system, priorities, forwarding.

d. Equipment:

1) Perform diagnostics per device.
2) View the status of a zone or station.

e. Purge: Purge system or zone.
f. Statistical:

1) View/print/reset maintenance schedules per device.
2) View/edit carrier distribution.
3) View/print/reset transaction counts, full station advisories, forwarded summaries.

g. History: Review, sort or print transactions and alarms according to definable parameters.
h. View: Customize screen parameters.
i. Help: Context sensitive on line help.

I. Multiple Zone Systems: Interzone tubing connections to provide tube connections between zones, called interzone lines, for temporary storage and transfer of carriers between two zones.

1. Provide for simultaneous carrier storage in interzone lines and independent zone operation.
2. Allow for more than one interzone line between any two zones to facilitate traffic flow.
3. Provide for alternate routing of carriers through intermediate zones.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Pneumatic tube system and components shall be anchored and fastened to building construction as required for a stable, secure installation. All exposed parts of pneumatic tube system and finish components shall be closely fit and joined to provide a neat uniform appearance.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. System Testing and Acceptance: Prior to a formal pneumatic tube system performance test, perform preliminary tests, verifying all components are in fully operational condition for carrier dispatch and receive between all possible station combinations.

1. Provide written notification to the Architect/Engineer 30 days in advance of the scheduled pneumatic tube system performance test. Provide all personnel, equipment and instruments required for such examination.

2. In the presence of the Architect and Owner, Perform all operational tests, inspecting pneumatic tube system components and verifying that the equipment is installed and operating in proper condition, according to the intent of the contract.

3.5 DEMONSTRATION AND TRAINING

A. Operator training: Train Owner's staff on-site in the use and operation of the pneumatic tube system. Training shall be provided for one person per station with a minimum of ten. Training shall include:

1. Commercially prepared videotape describing the pneumatic tube system and its capabilities and potential benefits.
2. Assistance in developing the protocol policies for the Owner's use of the pneumatic tube system.
3. Review of information and standards regarding regulations of OSHA, NACCLS, CDC, etc. for transport of hazardous materials in the pneumatic tube system.
4. Containment and immobilization of items transported in the pneumatic tube system.
5. Review of common pneumatic tube system alarms and their correction.
6. Use and functions of the pneumatic tube system.
7. Package of training materials for the Owner's trainers to use.
8. A decontamination/infection control procedure and a cleanout kit with procedures for cleaning liquid spills in the pneumatic tube system.

B. Maintenance training: Maintenance personnel as assigned by the Owner shall be trained on the job site in the proper maintenance and trouble shooting of the pneumatic tube system.

1. Training course shall be included at manufacturer's training facility for Owner's designated personnel in the repair and maintenance of the pneumatic tube system.

C. Provide operating and maintenance information in both electronic and paper format acceptable to the Owner. Included in the operating and maintenance information:

1. Pneumatic tube system components and part descriptions,
2. Starting and stopping procedures,
3. General operating instructions,
4. Specific maintenance and troubleshooting instructions,
5. Recommended service schedules for adjustment, lubrication and inspection.
6. Recommended spare parts inventory.

END OF SECTION

**MECHANICAL ENGINEER'S SEAL**


**ELECTRICAL ENGINEER'S SEAL**


**DIVISION 21 – FIRE SUPPRESSION**



**DIVISION 22 – PLUMBING**



**DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING**

**END OF INDEX**

# PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. In addition to Division 01 Specification Sections, related sections include the following:

1. Division 01 Section "Cutting and Patching"
2. Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
3. Division 03 Sections "Cast-in-Place Concrete" and "Miscellaneous Cast-in-Place Concrete".
4. Division 05 Section "Metal Fabrications" for structural steel.
5. Division 09 Sections "Interior Painting" and "Exterior Painting".
6. Division 08 Section "Access Doors and Frames" for access panels and doors.

## 1.2 RELATED REQUIREMENTS

A. All conditions imposed by these documents shall be applicable to all portions of the Work under this Division. These references are intended to point out specific items to the Contractor, but in no way relieve him of the responsibility of reading and complying with all relevant parts of the entire Specification.

B. The Contractor shall examine and coordinate with all Contract Drawings and Specifications, and all Addenda issued. Failure to comply shall not relieve them of responsibility. The omission of details of other portions of the Work from this Division shall not be used as a basis for a request for additional compensation.

C. The specific features and details for other portions of the Work related to the construction in progress or to the existing building(s) shall be determined by examination at the site.

1.

## 1.3 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Mechanical sleeve seals.
3. Sleeves.
4. Grout.
5. Fire-suppression equipment and piping demolition.
6. Equipment installation requirements common to equipment sections.
7. Painting and finishing.
8. Concrete bases.
9. Supports and anchorages.

## 1.4 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.5 SCOPE OF WORK

A. Inspection Of Site

1. The accompanying drawings do not indicate existing plumbing installations other than to identify modifications of and extensions thereof. The Contractor shall visit the site, inspect the installations and ascertain the conditions to be met and the work.
2. Failure to comply with an inspection of the site shall not constitute ground for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work under this Division.
3. Review construction details of the existing portion of the building during the site inspection and include all work required to modify the existing plumbing installations and install new materials, comprising a part of the plumbing installation, within the present structure.
4. Review all construction details of the new portion of the building as illustrated on the architectural and structural drawings and be guided thereby.

B. The Work shall include modifications and extensions to existing systems, and the modification of the existing structure as required accommodating the installation of the Work.

C. Refer to other Divisions of the Specifications for related Work.

D. Contractor shall install, hang, support, etc. all Fire Protection systems and equipment to satisfy all requirements of the applicable seismic zone using performance requirements and design criteria for project site as indicated by architect.

E. It is the intent, unless otherwise indicated, that all products and materials described and specified under this Division, shall be provided for a complete working system irrespective of use of the phrases "install", "furnish", "furnish and install", or "provide" as described above has been actually included.

F. The Contractor shall be responsible for all Work of every description in connection with this Division of the Specifications.

G. The Contractor shall specifically and distinctly assume, and does so assume, all risk for damage or injury from whatever cause to property or person used or employed on or in connection with this Work and of all damages or injury to any person or property wherever located, resulting from an action or operation under the Contract in connection with the Work, and undertake the promise to defend the Owner against all claims on account of any such damage or injury.

H. The Contractor will be held responsible for the satisfactory execution and completion of the Work in accordance with the true intent of the Documents.

I. The Contractor shall provide without extra charge all incidental items required as part of the Work, even though it may not be specifically indicated. If the Contractor has reason for objecting to the use of any material, equipment, device or method of construction as indicated, he shall make report of such objections to the Owner's Representative, obtain proper approval and adjustment to the Contract, and shall proceed with the Work.

J. Electric wiring

1. All electric wiring shall be installed under Division 26, except for such equipment items as are prewired at their point of manufacture and so delivered to the project, and except for the following:

a. Temperature Control Wiring and Power Wiring provided by controls contractor.

2. Prepare and submit for review wiring diagrams for all equipment furnished under this Division. Show on these diagrams all power, interlock, and control circuits. When the Architect takes no exception to these drawings, they shall become installation drawings for the Contractor.

1.6 ORDINANCES, PERMITS AND CODES

A. It shall be the Contractor's duty to perform the work and provide the materials covered by these specifications in conformance with all ordinances and regulations of all authorities having jurisdiction.

B. The work shall be in accordance with, but not limited to, the requirements of:

1. National Fire Protection Association

C. Codes and standards referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings, and specifications govern.

D. The Contractor shall obtain permits, plan checks, connection and specification fees, inspections, and approvals applicable to the Work as required by the regulatory authorities.

E. Fees and costs of any nature whatsoever incidental to permits, inspections, and approvals shall be assumed and paid by the Contractor.

F. The pro-rata costs, if any, for utilities serving this property will be paid for by the Owner and shall not be included as part of this Contract.

1.7 SUBMITTAL PROCEDURES

A. Common Requirements for Product Data: Where this Section and other Sections of this Division require Product Data to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Submit hardcopy of Product Data in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of product data submittals shall be bound materials as defined above. Separate products under distinct subheadings that correspond to paragraphs in specification text. Divide sections in binder with labeled divider tabs.

2. In addition to hardcopies required by Division 01, submit one copy of product data in electronic format. All files on disc shall be in Portable Document Format (.pdf).
3. Product Data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.

B. Product Data: For the following:

1. Dielectric fittings.
2. Mechanical sleeve seals.
3. Escutcheons.

C. Common Requirements for Shop Drawings: Where this Section and other Sections of this Division require Shop Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Prepare Shop Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®.
2. Submit hardcopy of Shop Drawings in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of Shop Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format. Files shall be include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
4. Shop Drawings shall be of appropriate scale based on the following:

   a. Piping Systems, including all underfloor work: Minimum 1/8" = 1'-0".
   b. Mechanical rooms: 1/4" = 1' – 0".

5. Shop drawings shall include the following items:

   a. Concrete pads and foundations.
   b. Equipment room layouts with actual dimensions and offsets for all systems.
   c. Drain locations.

D. Common Requirements for Coordination Drawings: Where this Section and other Sections of this Division require Coordination Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" and Division 01 Section "Project Management and Coordination". In addition to the requirements of Division 01 comply with the following:

1. Prepare Coordination Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®. Drawings files must be composite with multiple distinctive layers for each of the various trades.
2. Submit hardcopy of Coordination Drawings in the quantity as required under Division 01. Hardcopies of Coordination Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format. Files shall be include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
4. Coordination Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.
5. Coordination Drawings shall be multi-color prints with each system printed in a separate and unique color.

E. Coordination Drawings: Prepare drawings showing dimensioned layout for the following:

1. Penetration and Structural Opening: Floor plans showing sleeves and formed structural penetrations. Show sleeve and formed penetration layouts and relationships between structural components and other adjacent building elements, including but not limited to pre-tensioning and post-tensioning members where used.
2. Reflected Ceiling Plans: ceiling plans, sections, and other necessary details showing dimensioned layouts for equipment located in or on the ceiling plane. Base dimensions on exact dimensioned data obtained from product submittals for products to be included in the Work. Differentiate between field measurements and assumed dimensions. Include the all items in the ceiling plane coordinated with each other, based on input from installers of the items involved.
3. Include the following items coordinated with each other, based on input from installers of the items involved:

    a. Suspended ceiling components.
    b. Structural members to which suspension systems for luminaires will be attached.
    c. Perimeter moldings, decorative ceiling elements, and Architectural features.
    d. Luminaires.
    e. HVAC Diffusers, Registers and Grilles.
    f. Speakers.
    g. Sprinklers.
    h. Fire Alarm initiating devices, including but not limited to the following:

        1) Smoke detectors.
        2) Heat detectors.

    i. Fire Alarm notification appliances.
    j. Occupancy sensors.
    k. Access panels.
    l. Security cameras and occupancy detectors.
    m. Wireless Access Points.
    n. Nurse Call Zone and Dome Lights.
    o. Patient Telemetry Receivers and Equipment.

4. Sprinkler Layouts:

    a. Single-line drawings of sprinkler and piping systems are satisfactory.
    b. Shop drawings shall be provided for the following:

        1) Fire protection Systems, including all underfloor work (prepared at a <u>minimum</u> scale of 1/8"=1'-0")
        2) Equipment room layouts with actual equipment and piping at 1/4" = 1' – 0" scale. Show clearances, access spaces, relative heights of piping.
        3) Housekeeping and equipment concrete pads.
        4) Dimensioned floor drain locations and the equipment each serves.

    c. Equipment support locations, type of support, and weight on each support.
    d. Location of structural supports for structure-supported raceways.
    e. For floor mounted equipment: concrete base dimension, outline of equipment, and required clearances.
    f. Location of structural supports for seismic bracing.

F. Common Requirements for Specification Compliance Certification: Where this Section and other Sections of this Division require Specification Compliance Certification to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" for "Other Informational Submittals". In addition to the requirements of Division 01 comply with the following:

1. Prepare a line-by-line Specification Compliance Certification by marking up a copy of the Contract Document specification section in the left margin. Accompany the markup with a written report explaining all items that are not marked with "Compliance". Submit line-by-line markup, written report of deviations and alternates and a cover letter certified by Manufacturer or Installer that prepared the Specification Compliance Certification. Use the following key for preparing the line-by-line markup.

   a. "C" for Compliance: By noting the term "compliance" or "C" in the margin, it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
   b. "D" for Deviation: By noting the term "deviation" or "D" in the margin, it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified.
   c. "A" for Alternate: By noting the term "alternate" or "A" in the margin, it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner.
   d. "N/A" for Not Applicable: By noting the term "not applicable" or "N/A" in the margin, it shall be understood that the specified item is not applicable to the project.

G. Common Requirements For Qualification Data:

1. Professional Engineer Qualifications: Where this Section and other Sections of this Division require a Professional Engineer to be responsible for Delegated Design requirements; Submit Qualification data for Professional Engineer including, but not limited to, proof of registration in the Project location.
2. Independent Testing and Inspecting Agency Certification: Where this Section and other Sections of this Division require an Independent Testing and Inspecting agency to be responsible for Acceptance Testing and Field Quality Control requirements; Submit certification documentation for such agency that demonstrates compliance with the Quality Assurance paragraph of this Section.

H. Qualification Data: For Independent Testing and Inspecting Agency.

I. Welding certificates.

1.8 SUBSTITUTIONS

A. Where the product of a single manufacturer is mentioned by trade name or manufacturer's name in this Division, it is the only acceptable manufacturer.

B. Where two or more manufacturers are named, only those manufacturers will be considered or approved.

C. Manufacturers not listed will be considered for substitution prior to bid only. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum ten (10) business days prior to bid with each sub-paragraph noted with the comment, "compliance", "deviation", "alternate" or "not applicable". In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.

1. By noting the term "compliance" or "C", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
2. By noting the term "deviation" or "D", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
3. By noting the term "alternate" or "A", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the manufacturer proposes to provide.
4. By noting the term "not applicable" or "N/A", it shall be understood that the specified item is not applicable to the project.

D. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not.

E. Any product or material offered in substitution which differs in dimension or configuration from the Documents, the Contractor shall provide as part of the submittal a drawing, minimum 1/4" = 1'-0" scale, showing that the substitution can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.

F. Where substitute products or materials requiring different arrangement or connections from that indicated is accepted by the Owner's Representative, install the equipment or devices to operate properly and in harmony with the intent of the Documents, making all incidental changes in piping or wiring resulting from the substitution without any additional cost to the Owner.

G. The Contractor shall pay all additional costs incurred by other portions of the work in connection with all substitutions.

H. The Owner's Representative reserves the right to call for samples of any item of product or material offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.

I. When any request for a substitution of a product or material is submitted and rejected, the item named in the Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

1.9 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code-Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver products and materials with factory-applied end caps or "heat shrink" wrappings to protect openings. Maintain opening protection through shipping, storage, and handling to prevent damage and the entrance of dirt, debris, and moisture.

B. Store light sensitive products and materials away from and protected against direct sunlight.

C. Support products and materials at all times to prevent sagging and bending.

D. The area provided for product and material storage at the jobsite shall be clean, dry and exposure to dust minimized.

E. Responsibility for the protection of products and materials shall extend to existing equipment, systems, and products and materials. Erect temporary sheltering structures, provide temporary bracing and supports, or cover existing equipment, systems, and products and materials to prevent damage and the entrance of dirt, debris, and moisture.

F. Failure on the part of the Contractor to comply with the above to the satisfaction of the Architect, Engineer, or either's authorized representative shall be sufficient cause for the rejection of products and materials in question.

1.11 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

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

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. All piping and tubing shall be American manufactured, unless otherwise indicated.

2.3 JOINING MATERIALS

A. Refer to individual Division 21 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Innerlinx by Mason Dallas.
b. Metraflex Co.
c. Linkseal by Thunderline.

2. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 10, galvanized, plain ends.

B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 FIRE-SUPPRESSION DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Equipment to Be Removed: Disconnect and cap services and remove equipment.
3. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.

B. It is the intent of these Specifications to cover the design, hydraulic calculations, design and complete installation of the wet type automatic sprinkler, pre-action sprinkler or dry pipe sprinkler and standpipe system. The sprinkler contractor shall furnish and install the entire fire protection system, from the designated water supply connection to the final installation of each sprinkler head.

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 free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Sleeves are not required for core-drilled holes.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Penetration assemblies shall comply with U.L. Fire Resistance Directory requirements for wall penetrations
2. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

L. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

M. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

O. Verify final equipment locations for roughing-in.

P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

## 3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

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. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 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 not less than 4 inches larger in both directions than supported unit.
2. Concrete bases for all equipment shall be 4 inches (100 mm) tall above finished floor.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 GROUTING

A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.8 INSTALLATION, INSPECTIONS AND CERTIFICATIONS

A. The Contractor shall obtain timely inspections of the installation by the constituted authorities. Remedy any deficiencies to the satisfaction of the inspecting authority.

B. Upon final completion of the work, obtain certificates of acceptance from the constituted authorities. Deliver the certificates to the Architect for transmission to the Owner.

3.9 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers and/or technicians acceptable to the Owner's Representative to instruct other representatives of the Owner in the complete and detailed operation of each item of equipment or device of all the various electrical systems. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results.

B. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

C. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given the Owner's personnel and the letter of release acknowledged.

D. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals.

E. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturer's operating and maintenance instructions, parts lists (with sources identified), and other data as appropriate for each system.

END OF SECTION 210500

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Requirements for Manufacturer Seismic Certification.
2. Requirements for Manufacturer Special Seismic Certification.
3. Isolation pads.
4. Elastomeric hangers.
5. Pipe riser resilient supports.
6. Resilient pipe guides.
7. Seismic snubbers.
8. Restraining braces.
9. Steel and inertia, vibration isolation equipment bases.

B. Related Sections include the following:

1. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.
2. Division 23 Section "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

## 1.2 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

D. Seismic Certification: Seismic certification refers to a manufacturer's certification for architectural, mechanical, and electrical components, supports, and attachments pursuant to ASCE/SEI 7-05 Section 13.2.1.2.

E. Seismic Qualification: Same as Special Seismic Certification

F. Special Seismic Certification: Seismic certification of mechanical and electrical equipment based on ASCE/SEI 7-05 Section 13.2.2. Special Seismic Certification is required for active mechanical and electrical equipment that must remain operable following the design earthquake.

## 1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for vibration and seismic controls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Do not use more than one pre-approved seismic-force resistance system on any single run of pipe, duct or conduit. Mixing of multiple pre-approved systems is not acceptable.

B. Seismic-Restraint Loading: In preparation of Delegated Design, utilize seismic forces as described in ASCE 7-02 "Minimum Design Loads for Buildings and Other Structures" as published by the American Society of Civil Engineers, unless requirements in this Section are more stringent.

1. Site Class as Defined in the IBC: _.
2. Assigned Seismic Design Category as Defined in the IBC: D. (Bracing of non-structural elements is required.)

a. Component Importance Factor: 1.5.
b. Assign component factors based on ASCE-7 Table 13.6-1 for the following:

1) Component Response Modification Factor.
2) Component Amplification Factor.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second):

a. $S_S$ = 0.331g.
b. $S_{DS}$ = 0.339g.

4. Design Spectral Response Acceleration at 1-Second Period:

a. $S_1$ = 0.108g.
b. $S_{D1}$ = 0.171g.

C. Submittal Review Conference: At time of Delegated Design Shop Drawing submission, schedule a submittal review conference with the Architect and Structural Engineer-of-Record for the project. The purpose of this conference is to review attachment locations and insure supplementary framing that is needed to resist the loads, maintain stability or to meet other installation requirements of a pre-approved system have been accounted for in the Structural Engineer-of-Record's design.

1.4 SUBMITTALS

A. Product Data: For the following:

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 seismic-restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD, and an agency acceptable to authorities having jurisdiction.
b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

4. Seismic-Restraint Details:

   a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
   c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD, and an agency acceptable to authorities having jurisdiction showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings:

1. Show coordination of seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
2. Submit approval from Structural Engineer where supports connect directly to structure.

D. Welding certificates.

E. Common Requirements For Qualification Data:

1. Manufacturer Seismic Qualification Certification: Where this Section and other Sections of this Division require products to meet seismic requirements; Submit certification that equipment, devices, accessories, and components will withstand seismic forces defined in this Section. Include the following:

   a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

      1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

2. Manufacturer Special Seismic Certification: Where this Section and other Sections of this Division require products to meet seismic requirements; Submit certification that equipment, devices, accessories, and components will withstand seismic forces defined in this Section. Include the following:

   a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

      1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Qualification Data: For professional engineer and testing agency.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vibration Isolation and Control

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. ISAT

4. Kinetics Noise Control.
5. Korfund Company.
6. Mason Industries.
7. Vibration Eliminator Company.
8. Vibration Mountings & Controls, Inc.

B. Seismic Restraint

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.
4. ISAT
5. Kinetics Noise Control.
6. Korfund Company.
7. Mason Industries.
8. TOLCO Incorporated.
9. Unistrut; Tyco International, Ltd.

2.2 VIBRATION ISOLATORS

A. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

B. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

C. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch-thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

D. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch-thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

A. Housekeeping Pads: 4" or 6" tall with 1" chamfer on all top edges.

B. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

a. Include supports for suction and discharge elbows for pumps.
b. The weight of each inertial block shall not be less than 150% of supported equipment.
c. Extend block minimum 4" beyond equipment base.
d. Chamfer edges minimum 1".

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.4 SEISMIC-RESTRAINT DEVICES

A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES, OSHPD, and an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

B. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Hanger Rod Stiffener:

1. Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
2. Reinforcing steel angle clamped to hanger rod.

E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

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 APPLICATIONS

A. Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, OSHPD, and an agency acceptable to authorities having jurisdiction.

B. Install hanger rod stiffeners to prevent buckling of hanger rods due to seismic forces.

C. Base: None.

1. Suspended Equipment:

a. Suspended Expansion Tanks.
b. Domestic hot water circ. Pumps.
c. Piping in Mechanical Rooms.

2. Isolator: Spring hanger with 2" deflection.

D. Base: Reinforced Concrete Inertia Block

1. Equipment: Pumping Systems

   a. Fire.
   b. Domestic water.

2. Isolator: Freestanding, open spring type with 1.5" deflection.

E. Base: 4" Housekeeping Pad

1. Equipment:

   a. Floor mounted Reciprocating Air Compressors.

2. Isolator: Restrained, open spring type with 2" deflection.

F. Miscellaneous Systems

1. Jockey Pump

   a. Base: 6" housekeeping pad.
   b. Isolator: None.

2. Rotary, Centrifugal, and Screw Air Compressors

   a. Base: 4" Housekeeping pad.
   b. Isolator: Restrained, open spring type with 1" deflection.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches.
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, and an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

C. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, and an agency acceptable to authorities having jurisdiction providing required submittals for component.

D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

E. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

F. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

## 3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 21 Section "Water Based Fire Suppression Systems" for piping flexible connections.

## 3.5 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. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

END OF SECTION 210548

# PART 1 - GENERAL

## 1.1 SUMMARY

A. Section includes the following fire-suppression piping inside the building:

1. Automatic wet-type, Class I standpipe systems.
2. Wet-pipe sprinkler systems.

B. Related Sections include the following:

1. Division 10 Section "Fire Extinguisher Cabinets" and "Fire Extinguishers" for cabinets and fire extinguishers.
2. Division 28 Section "Fire Detection and Alarm" for alarm devices not specified in this Section.
3. Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

## 1.2 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

## 1.3 SYSTEM DESCRIPTIONS

A. Automatic Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.

B. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

## 1.4 PERFORMANCE REQUIREMENTS

A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.

B. Fire-suppression standpipe system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent or 10 psi whichever is greater, including losses through water-service piping, valves, and backflow preventers.
2. Minimum residual pressure at each hose-connection outlet is the following:

   a. NPS 2-1/2 Hose Connections: 100 psig.

3. Unless otherwise indicated, the following is maximum residual pressure at required flow at each hose-connection outlet:

   a. NPS 2-1/2 Hose Connections: 175 psig.

C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent or 10 psi whichever is greater, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications shall be in accordance with the latest edition of NFPA 13.

3. Minimum Density for Automatic-Sprinkler Piping Design: Per NFPA 13
4. Minimum Density for Deluge-Sprinkler Piping Design: Per NFPA 13
5. Maximum Protection Area per Sprinkler: Per NFPA 13
6. Total Combined Hose-Stream Demand Requirement: Per NFPA 13

D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.5 SUBMITTALS

A. Product Data: For the following:

1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
2. Pipe hangers and supports, including seismic restraints.
3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
4. Air compressors, including electrical data.
5. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
6. Hose connections, including size, type, and finish.
7. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
8. Alarm devices, including electrical data.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Fire-hydrant flow test report.

D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.

E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

F. Welding certificates.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For standpipe and sprinkler specialties to include in emergency, operation, and maintenance manuals.

I. Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable style or series number.

J. Sprinklers 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 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

D. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied from the same manufacturer as the grooved components.

1.7 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

B. Grooved-End, Ductile-Iron Pipe: AWWA C151, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Victaulic Co. of America.
2) Anvil International.

b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD.
c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, synthetic rubber gasket with center leg, and steel bolts and nuts.
d. Grooved-End-Pipe Transition Coupling: UL 213 and AWWA C606, gasketed fitting with end matching ductile-iron-pipe OD and end matching steel-pipe OD. Include ductile-iron housing with key matching ductile-iron-pipe groove and key matching steel-pipe groove, cast with offsetting, angle-pattern bolt pads, synthetic rubber gasket with center leg, listed for use with housing, and steel bolts and nuts.
e. Grooved-End Transition Flange: UL 213, gasketed fitting with key for ductile-iron-pipe dimensions. Include flange-type, ductile-iron housing with synthetic rubber gasket listed for use with housing and steel bolts and nuts.

2.2 STEEL PIPE AND FITTINGS

A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865.

B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

C. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Anvil International, Inc.
2) TYCO
3) Victaulic Co. of America.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD or ASTM A 53 forged or fabricated from carbon steel pipe with factory grooved ends designed to accept grooved mechanical couplings from the same manufacturer.

c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, synthetic rubber gasket listed for use with housing, and steel bolts and nuts.

1) Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. Tongue and recess rigid type couplings shall only be used if the contractor uses a torque wrench for installation. Required torque shall be in accordance with the manufacturer's latest recommendations.

a) 1-1/4" through 4": "Installation Ready" stab-on design, for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts.
b) 5" and larger: Standard rigid coupling.

2) Flexible Type: Use in seismic areas where required by NFPA 13.

a) 2" through 8": "Installation Ready" stab-on design, for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts.
b) 10" and larger: Standard flexible coupling.

d. Grooved-End-Pipe Flange Adapters: UL213 and AWWA C606, steel pipe OD dimensions, ASTM A536 ductile iron housing, flat faced, designed for incorporating flanged components with ANSI Class 125 bolt-hole patterns to a grooved piping system.

D. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13 specified wall thickness in NPS 6 to NPS 10.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

E. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 4 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10; with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Anvil International, Inc.
2) TYCO
3) Victaulic Co. of America.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD or ASTM A 53 forged or fabricated from carbon steel pipe with factory grooved ends designed to accept grooved mechanical couplings from the same manufacturer.

c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.

1) Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. Tongue and recess rigid type couplings shall only be used if the contractor uses a torque wrench for installation. Required torque shall be in accordance with the manufacturer's latest recommendations.

a) 1-1/4" through 4": "Installation Ready" stab-on design, for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts.
b) 5" and larger: Standard rigid coupling.

2) Flexible Type: Use in seismic areas where required by NFPA 13.

a) 2" through 8": "Installation Ready" stab-on design, for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts.
b) 10" and larger: Standard flexible coupling.

d. Grooved-End-Pipe Flange Adapters: UL213 and AWWA C606, steel pipe OD dimensions, ASTM A536 ductile iron housing, flat faced, designed for incorporating flanged components with ANSI Class 125 bolt-hole patterns to a grooved piping system.

## 2.3 DIELECTRIC FITTINGS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

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

B. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.

C. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.

D. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig minimum working-pressure rating as required for piping system.

E. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig working-pressure rating at 225 deg F.

F. Dielectric Nipples: Electroplated steel or ductile iron with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig working-pressure rating at 230 deg F.

2.4 FLEXIBLE CONNECTORS

A. Flexible connectors shall have materials suitable for system fluid. Include 250-psig minimum working-pressure rating and ends according to the following:

1. NPS 2 and Smaller: Threaded.
2. NPS 2-1/2 and Larger: Flanged.
3. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.

B. Manufacturers:

1. Flexhead Industries, Inc.
2. Flexicraft Industries.
3. Flex-Pression, Ltd.
4. Proco Products, Inc.
5. Unaflex Inc.

C. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

D. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

E. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.5 CORROSION-PROTECTIVE ENCASEMENT FOR PIPING

A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

2.6 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 300-psig working-pressure rating if fittings are components of high-pressure piping system.

B. Outlet Specialty Fittings:

1. Manufacturers:

a. Anvil International, Inc.
b. TYCO
c. Victaulic Co. of America.

2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with locating collar to ensure proper installation, synthetic rubber gaskets, bolts and nuts, and threaded or grooved outlets.
3. Snap-On and Strapless Outlet Fittings: UL 213, ductile-iron housing or casting with gasket and threaded outlet.

C. Sprinkler Drain and Alarm Test Fittings: Bronze, Cast- or ductile-iron body; with threaded or grooved inlet and outlet, test valve, and orifice and sight glass.

1. Manufacturers:

a. TYCO
b. Fire-End and Croker Corp.
c. Viking Corp.
d. Victaulic Co. of America.

D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

1. Manufacturers:

a. Elkhart Brass Mfg. Co., Inc.
b. Fire-End and Croker Corp.
c. Potter-Roemer; Fire-Protection Div.

E. Sprinkler Inspector's Test Fitting: Bronze, Cast- or ductile-iron housing with threaded or grooved inlet and drain outlet and sight glass.

1. Manufacturers:

a. AGF Manufacturing Co.
b. TYCO
c. G/J Innovations, Inc.
d. Triple R Specialty of Ajax, Inc.
e. Victaulic Company

F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

1. Manufacturers:

a. CECA, LLC.
b. Merit.

2.7 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Valves shall have 300-psig pressure rating if valves are components of high-pressure piping system.

B. Gate Valves with Wall Indicator Posts:

1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
2. Gate Valves: UL 262, ductile-iron body, bronze mounted, EPDM coated cast iron disc, brass stem, grooved ends, with horizontal-wall type, or upright post indicator.
3. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with operating wrench or hand wheel, extension rod, locking device, and cast-iron barrel.
4. Manufacturers:

a. Grinnell Fire Protection.

b. McWane, Inc.; Kennedy Valve Div.
c. NIBCO.
d. Stockham.
e. Victaulic Company.

C. Ball Valves: Comply with UL 1091, except with ball instead of disc.

1. NPS 1-1/2 and Smaller: Bronze body with threaded or grooved ends.
2. NPS 2 and NPS 2-1/2: Bronze body with threaded or grooved ends or ductile-iron body with grooved ends.
3. Manufacturers:

a. NIBCO.
b. Victaulic Co. of America.

D. Butterfly Valves: UL 1091.

1. NPS 3 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends. Weather-proof actuator with pre-wired supervisory switches monitoring the valve in the open or closed positions. Maximum 365 psig (2517 kPa) working pressure.

a. Manufacturers:

1) TYCO
2) Global Safety Products, Inc.
3) McWane, Inc.; Kennedy Valve Div.
4) Mueller Company.
5) NIBCO.
6) Pratt, Henry Company.
7) Victaulic Co. of America.

E. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron or ductile-iron body with flanged or grooved ends. Up to 365 psig (2517 kPa) maximum working pressure.

1. Manufacturers:

a. TYCO
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Globe Fire Sprinkler Corporation.
d. Grinnell Fire Protection.
e. Mueller Company.
f. NIBCO.
g. Potter-Roemer; Fire Protection Div.
h. Reliable Automatic Sprinkler Co., Inc.
i. Stockham.
j. Victaulic Co. of America.
k. Watts Industries, Inc.; Water Products Div.

F. Gate Valves: UL 262, OS&Y type.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. Manufacturers:

1) Crane Co.; Crane Valve Group; Crane Valves.

2) NIBCO.

2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.

a. Manufacturers:

1) Crane Co.; Crane Valve Group; Crane Valves.
2) Milwaukee Valve Company.
3) Mueller Company.
4) NIBCO.
5) Victaulic Company.

G. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch.
2. NPS 2-1/2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.

a. Manufacturers:

1) Milwaukee Valve Company.
2) NIBCO.
3) Victaulic Co. of America.

3. NPS 3 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

a. Manufacturers:

1) TYCO
2) Grinnell Fire Protection.
3) Milwaukee Valve Company.
4) NIBCO.
5) Victaulic Co. of America.

2.8 BACKFLOW PREVENTERS

A. Double-Check Backflow-Prevention Assemblies:

1. Manufacturers:

a. Conbraco Industries, Inc.
b. FEBCO; SPX Valves & Controls.
c. Watts Industries, Inc.; Water Products Div.
d. Zurn Plumbing Products Group.

2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or steel with interior lining complying with AWWA C550 for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

B. Reduced-Pressure-Detector, Fire-Protection Backflow-Preventer Assemblies:

1. Manufacturers:

a. Conbraco Industries, Inc.
b. FEBCO; SPX Valves & Controls.
c. Watts Industries, Inc.; Water Products Div.
d. Zurn Plumbing Products Group.

2. Standard: ASSE 1047 and FMG approved or UL listed.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Cast iron with interior lining complying with AWWA C550 or Steel with interior lining complying with AWWA C550.
6. End Connections: Flanged.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

C. Double-Check, Detector-Assembly Backflow Preventers:

1. Manufacturers:

a. Conbraco Industries, Inc.
b. FEBCO; SPX Valves & Controls.
c. Watts Industries, Inc.; Water Products Div.
d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1048 and FMG approved or UL listed.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Body: Cast iron with interior lining complying with AWWA C550 or Steel with interior lining complying with AWWA C550.
6. End Connections: Flanged.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet.
b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

## 2.9 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating. Control valves shall have 300-psig pressure rating if valves are components of high-pressure piping system.

1. Manufacturers:

   a. TYCO
   b. Globe Fire Sprinkler Corporation.
   c. Grinnell Fire Protection.
   d. Reliable Automatic Sprinkler Co., Inc.
   e. Victaulic Co. of America.
   f. Viking Corp.

2. Alarm Check Valves: UL 193, designed for vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer. Valve internal components shall be replaceable without removing the valve from the installed position.

   a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

3. Dry-Pipe Valves: UL 260, differential type; with bronze or brass seat with Nitrile O-ring seals, single-hinge pin, and latch design. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment. Minimum required air pressure is 13 psi with low pressure actuator and 300 psig maximum water pressure rating in all sizes. Valve internal components shall be replaceable without removing the valve from the installed position and shall be externally resettable. Valve shall be supplied completely assembled with shutoff valve, pre-set pressure switches and drain kit.

   a. Air Compressor: UL 753, fractional horsepower, 120-V ac, 60 Hz, single phase.

      1) Manufacturers:

         a) TYCO
         b) Gast Manufacturing, Inc.
         c) Grinnell Fire Protection.
         d) Reliable Automatic Sprinkler Co., Inc.
         e) Viking Corp.
         f) Victaulic Company

   b. Air Compressor/Air Maintenance Assembly: Consisting of a riser mounted compressor, air maintenance device, and flexible hoses for installation. Assemble shall be designed to ensure operational air pressure within 30 minutes of discharge.

4. Pre-Action Valves: UL 260, low differential, latched clapper design, with black enamel coated ductile iron body, tapped for main drain and all available trim configurations, aluminum bronze clapper with synthetic rubber seat, stainless steel spring and shaft, brass seat and Nitrile seat o-rings. Valve internal parts shall be replaceable without removing the valve from the installed position and shall be externally resettable. Maximum water pressure is 300 psig in all sizes and minimum required air pressure is 13 psig with low pressure actuator for pneumatic activation or solenoid valve for electrical activation. Valve shall have grooved ends for vertical installation. Separate check valve downstream is not required.

   a. Air Compressor: UL 753, fractional horsepower, 120-V ac, 60 Hz, single phase.

      1) Manufacturers:

         a) TYCO

b) Gast Manufacturing, Inc.
c) Grinnell Fire Protection.
d) Reliable Automatic Sprinkler Co., Inc.
e) Viking Corp.
f) Victaulic Company

B. Pressure-Regulating Valves: UL 1468, brass or bronze, NPS 1-1/2 and NPS 2-1/2, 400-psig minimum rating. Include female NPS inlet and outlet, adjustable setting feature, and straight or 90-degree-angle pattern design as indicated.

1. Finish: Rough metal.
2. Manufacturers:

a. Elkhart Brass Mfg. Co., Inc.
b. Fire-End and Croker Corp.
c. GMR International Equipment Corporation.
d. Grinnell Fire Protection.
e. Potter-Roemer; Fire Protection Div.
f. Zurn Industries, Inc.; Wilkins Div.

C. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.

1. Manufacturers:

a. AFAC Inc.
b. Grinnell Fire Protection.

2.10 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have 300-psig pressure rating if sprinklers are components of high-pressure piping system.

B. Manufacturers:

1. TYCO
2. Reliable Automatic Sprinkler Co., Inc.
3. Victaulic Co. of America.
4. Viking Corp.

C. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for nonresidential applications.
2. UL 1767, for early-suppression, fast-response applications.

D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

1. All Sprinklers shall be Quick Response.

2. Minimum 11.2 K-factor for heads serving generator rooms and fuel storage rooms.
3. Extended coverage heads are not permitted.

E. Sprinkler types, features, and options as follows:

1. Concealed ceiling sprinklers, including cover plate.
2. Extended-coverage sprinklers.
3. Flush ceiling sprinklers, including escutcheon.
4. High-pressure sprinklers.
5. Institution sprinklers, made with a small, breakaway projection.
6. Pendent sprinklers.
7. Pendent, dry-type sprinklers.
8. Quick-response sprinklers.
9. Recessed sprinklers, including escutcheon.
10. Sidewall sprinklers.
11. Sidewall, dry-type sprinklers.
12. Upright sprinklers.

F. Sprinkler Finishes: Chrome plated, bronze, and painted.

G. Special Coatings: Corrosion-resistant paint or Nickel-Teflon.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler. Sprinkler guards shall be listed, supplied, and approved for use with the sprinkler, by the sprinkler manufacturer.

## 2.11 FIRE HOSE VALVES

A. Manufacturers:

1. Elkhart Brass Mfg. Co., Inc.
2. Croker Corp.
3. Guardian Fire Equipment Incorporated.
4. McWane, Inc.; Kennedy Valve Div.
5. Mueller Company.
6. Potter-Roemer; Fire-Protection Div.

B. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include angle pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain.NPS 2-1/2 by NPS 1-1/2 reducer adapter and hose valve threads according to NFPA 1963 and matching local fire department threads.

1. Valve Operation: Nonadjustable type, unless pressure-regulating type is required.
2. Finish: Rough metal or chrome-plated.

## 2.12 FIRE VALVE CABINETS

A. Manufacturers:

1. Elkhart Brass Mfg. Co., Inc.

2. Croker Corp.
3. Grinnell Fire Protection.
4. Guardian Fire Equipment Incorporated.
5. McWane, Inc.; Kennedy Valve Div.
6. Mueller Company.
7. Potter-Roemer; Fire-Protection Div.

B. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include angle pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain.NPS 2-1/2 by NPS 1-1/2 reducer adapter and hose valve threads according to NFPA 1963 and matching local fire department threads.

1. Valve Operation: Nonadjustable type, unless pressure-regulating type is required.
2. Finish: Rough metal or chrome-plated.
3. Mountings: Pipe escutcheon for cabinet-mounted units.

C. Recessed mounted valve cabinet of 20 ga. Steel. Refer to architect for door and finish requirements. Cabinet must be large enough to accommodate hose valve indicated.

2.13 FIRE DEPARTMENT CONNECTIONS

A. Manufacturers:

1. TYCO
2. Elkhart Brass Mfg. Co., Inc.
3. Croker Corp.
4. Guardian Fire Equipment Incorporated.
5. Potter-Roemer; Fire-Protection Div.

B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR & STANDPIPE."

1. Type: Flush, with four inlets and square or rectangular escutcheon plate.

2. Type: Exposed, projecting, with two inlets and round escutcheon plate.
3. Finish: Polished chrome-plated.

C. Exposed, Freestanding-Type, Fire Department Connection: UL 405, 300-psig pressure rating; with corrosion-resistant-metal body, brass inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, and bottom outlet with pipe threads. Include brass lugged caps, gaskets, and brass chains; brass lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch-high, brass sleeve; and round, floor, brass escutcheon plate with marking "AUTO SPKR & STANDPIPE."

1. Finish Including Sleeve: Polished chrome-plated.

2.14 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch-diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.

1. Manufacturers:

a. TYCO
b. Globe Fire Sprinkler Corporation.
c. Reliable Automatic Sprinkler Co., Inc.
d. Victaulic Company.
e. Viking Corp.

C. Electrically Operated Alarm: UL 464, with 8-inch-minimum- diameter, vibrating-type, metal alarm bell with red-enamel factory finish and suitable for outdoor use.

1. Manufacturers:

a. Potter Electric Signal Company.
b. System Sensor.

D. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

1. Manufacturers:

a. ADT Security Services, Inc.
b. Grinnell Fire Protection.
c. ITT McDonnell & Miller.
d. Potter Electric Signal Company.
e. System Sensor.
f. Viking Corp.
g. Watts Industries, Inc.; Water Products Div.

E. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.

1. Manufacturers:

a. Grinnell Fire Protection.
b. Potter Electric Signal Company.
c. System Sensor.
d. Viking Corp.

F. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

1. Manufacturers:

a. McWane, Inc.; Kennedy Valve Div.

b. Potter Electric Signal Company.
c. System Sensor.

G. Indicator-Post Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.

1. Manufacturers:

a. Potter Electric Signal Company.
b. System Sensor.

2.15 PRESSURE GAGES

A. Available Manufacturers:

1. AGF Manufacturing Co.
2. AMETEK, Inc.; U.S. Gauge.
3. Brecco Corporation.
4. Dresser Equipment Group; Instrument Div.
5. Marsh Bellofram.
6. WIKA Instrument Corporation.

B. Description: UL 393, 3-1/2- to 4-1/2-inch-diameter, dial pressure gage with range of 0 to 300 psig.

1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13, NFPA 14, and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 EXAMINATION

A. Examine roughing-in for hose valves and fire valve cabinets to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose valve cabinets are to be installed.

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

3.3 PIPING APPLICATIONS, GENERAL

A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

B. Underground Service Piping: Ductile-iron, grooved-end pipe and fittings; grooved-end-pipe couplings; and grooved joints. Include corrosion-protective encasement.

3.4 STANDPIPE SYSTEM PIPING APPLICATIONS

A. Standard-Pressure, Wet-Type or Dry-Type Standpipe System, 175-psig Maximum Working Pressure:

1. NPS 8 and smaller: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
2. NPS 8 and smaller: Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
3. NPS 8 and smaller: Grooved-end, black or galvanized, standard-weight steel pipe with roll-grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
4. NPS 8: Plain-end, Schedule 10 steel pipe; steel welding fittings; and welded joints.
5. NPS 8: Grooved-end, Schedule 10 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. High-Pressure, Wet-Type or Dry-Type Standpipe System, 175- to 250-psig Working Pressure:

1. NPS 8 and Smaller: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
2. NPS 8 and Smaller: Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
3. NPS 8 and Smaller: Grooved-end, black or galvanized, standard-weight steel pipe with roll-grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.5 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Standard-Pressure, Wet-Pipe or Dry-pipe Sprinkler System, 175-psig Maximum Working Pressure:

1. NPS 2: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

2. NPS 2-1/2 to NPS 6: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
3. NPS 2-1/2 to NPS 6: Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
4. NPS 2-1/2 to NPS 6: Grooved-end, black or galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. High-Pressure, Wet-Pipe and Dry-pipe Sprinkler System, 175- to 250-psig Working Pressure:

1. NPS 2: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

2. NPS 2-1/2 to NPS 6: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
3. NPS 2-1/2 to NPS 6: Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
4. NPS 2-1/2 to NPS 6: Grooved-end, black or galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.6 VALVE APPLICATIONS

A. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.

1. Shutoff Duty: Use ball, butterfly, or gate valves.

3.7 JOINT CONSTRUCTION

A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping joint construction.

B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.

C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.

1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
2. Steel Pipe: Roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
3. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.
4. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the grooved coupling manufacturer.
5. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing.

D. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.

1. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
2. NPS 2-1/2 to NPS 4: Use dielectric flanges.
3. NPS 5 and Larger: Use dielectric flange insulation kits.

3.8 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 22 Section "Facility Water Distribution Piping" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 22 Section "Facility Water Distribution Piping" for backflow preventers.

3.9 WATER-SUPPLY CONNECTION

A. Connect fire-suppression piping to building's interior water distribution piping. Refer to Division 22 Section "Domestic Water Piping" for interior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water distribution piping. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.

3.10 PIPING INSTALLATION

A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping installation.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Install underground ductile-iron service-entrance piping according to NFPA 24 and with restrained joints. Encase piping in corrosion-protective encasement.

D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install drain valves on standpipes.

K. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

L. Install alarm devices in piping systems.

M. Hangers and Supports: Comply with NFPA 13 for hanger materials.

1. Install standpipe system piping according to NFPA 14.
2. Install sprinkler system piping according to NFPA 13.

N. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.

1. In grooved piping systems, seismic motion shall be accommodated by installing swing joints consisting of flexible couplings, pipe nipples and elbows that provide simultaneous movement in all directions, or other seismic movement compensation devices such as loops, offsets, or expansion joints when an in-line device is required, to provide flexibility to the system and help reduce pipe stresses.

O. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

P. Drain dry-type standpipe piping.

Q. Drain dry-pipe sprinkler piping.

R. Pressurize and check dry-pipe sprinkler system piping and air compressors.

S. Fill wet-standpipe system piping with water.

T. Fill wet-pipe sprinkler system piping with water.

U. Install flexible connectors on fire-pump and jockey pump supply and discharge connections.

V. Grooved-end-pipe flexible couplings may be used in lieu of flexible connectors for vibration isolation at equipment connections. A minimum of three (3) couplings, for each connector, shall be placed in close proximity to the source of vibration.

3.11 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

D. Specialty Valves:

1. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.
2. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

a. Install air compressor and compressed-air supply piping.

3.12 SPRINKLER APPLICATIONS

A. Where specific types are not indicated, use the following sprinkler types:

1. Rooms without Ceilings: Upright sprinklers.
2. Public areas with Suspended Ceilings: Concealed sprinklers.

3. Lobbies, elevator lobbies, waiting rooms, operating and delivery rooms, imaging, ICU/CCU, Cath Lab, Critical Care, Intensive Care, Special Procedure, Angio, Patient sleeping areas, central sterile, clean rooms/clean processing and sterile compounding: Concealed sprinklers or match existing.
4. All other areas with Suspended Ceilings: Semi-Recessed sprinklers.
5. Non-public areas with Suspended Ceilings: Semi-Recessed sprinklers.
6. Wall Mounting: Sidewall sprinklers.
7. Special Applications: All Sprinkler heads to be Quick Response type.
8. Sprinkler Finishes:

    a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
    b. Concealed Sprinklers: Rough brass, with factory-painted bright white cover plate.
    c. Flush Sprinklers: Bright chrome, with painted bright white escutcheon.
    d. Semi-Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

3.13 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

D. The sprinkler bulb protector must remain in place until the sprinkler is completely installed and before the system is placed in service. Remove bulb protectors carefully by hand after installation. Do not use any tools to remove bulb protectors.

E. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

3.14 FIRE HOSE VALVE INSTALLATION

A. Install hose connections adjacent to standpipes, unless otherwise indicated.

B. Install freestanding hose connections for access and minimum passage restriction.

C. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 reducer adapter and flow-restricting device, unless otherwise indicated.

3.15 FIRE VALVE CABINET INSTALLATION

A. Install recessed hose stations for access and minimum passage restriction.

B. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 reducer adapter and flow- restricting device, unless otherwise indicated.

C. Install wall-mounting, recessed type fire hose valves in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Cabinets are specified in Division 10 Section "Fire Extinguisher Cabinets."

3.16 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire department connections in vertical wall.

B. Install freestanding-type, fire department connections in level surface.

1. Install protective pipe bollards as required. Refer to Division 05 Section "Metal Fabrications" for pipe bollards.

C. Install ball drip valve at each check valve for fire department connection.

D. Install ball drip valve and check valve for free standing fire department connections in accessible pit.

3.17 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.

D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

F. Connect compressed-air supply to dry-pipe sprinkler piping.

G. Connect air compressor to the following piping and wiring:

1. Pressure gages and controls.
2. Electrical power system.
3. Fire alarm devices, including low-pressure alarm.

H. Electrical Connections: Power wiring is specified in Division 26.

I. Connect alarm devices to fire alarm.

J. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

K. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

L. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.18 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14.

3.19 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

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. Energize circuits to electrical equipment and devices.
4. Start and run air compressors.
5. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
6. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
7. Coordinate with fire alarm tests. Operate as required.
8. Coordinate with fire-pump tests. Operate as required.
9. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.20 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

3.21 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 01 Section "Demonstration and Training."

B. Grooved coupling manufacturer's factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

END OF SECTION 211000

# PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. In addition to Division 01 Specification Sections, related sections include the following:

1. Division 01 Section "Cutting and Patching"
2. Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
3. Division 03 Sections "Cast-in-Place Concrete" and "Miscellaneous Cast-in-Place Concrete".
4. Division 05 Section "Metal Fabrications" for structural steel.
5. Division 09 Sections "Interior Painting" and "Exterior Painting".
6. Division 08 Section "Access Doors and Frames" for access panels and doors.

## 1.2 RELATED REQUIREMENTS

A. All conditions imposed by these documents shall be applicable to all portions of the Work under this Division. These references are intended to point out specific items to the Contractor, but in no way relieve him of the responsibility of reading and complying with all relevant parts of the entire Specification.

B. The Contractor shall examine and coordinate with all Contract Drawings and Specifications, and all Addenda issued. Failure to comply shall not relieve them of responsibility. The omission of details of other portions of the Work from this Division shall not be used as a basis for a request for additional compensation.

C. The specific features and details for other portions of the Work related to the construction in progress or to the existing building(s) shall be determined by examination at the site.

## 1.3 SUMMARY

A. This Section includes the following:

1. Scope of work.
2. Piping materials and installation instructions common to most piping systems.
3. Transition fittings.
4. Dielectric fittings.
5. Mechanical sleeve seals.
6. Sleeves.
7. Escutcheons.
8. Grout.
9. Plumbing demolition.
10. Equipment installation requirements common to equipment sections.
11. Painting and finishing.
12. Concrete bases.
13. Supports and anchorages.

1.4 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. Products and Materials: Components and assemblies for the construction of the systems as indicated in the Documents including, but not limited to pipes, tubes, valves, and equipment.

G. Products or Materials: See "Products and Materials".

H. Provide: The materials and equipment described shall be furnished, installed and connected under this Division, complete for operation, unless specifically noted to the contrary. Identical to the phrase "furnish and install".

I. Furnish: The material, equipment, etc. to be supplied, but not installed by the supplier.

J. The following are industry abbreviations for materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.
4. EPDM: Ethylene-propylene-diene terpolymer rubber.
5. NBR: Acrylonitrile-butadiene rubber.

K. VFD: Variable frequency drive. This may be used interchangeably with VSD (variable speed drive), VSC (variable speed controller), and VFMC (variable frequency motor controller). This technology varies the frequency of the incoming electrical signal to change the speed of driven equipment.

1.5 SCOPE OF WORK

A. Inspection Of Site

1. The accompanying drawings do not indicate existing plumbing installations other than to identify modifications of and extensions thereof. The Contractor shall visit the site, inspect the installations and ascertain the conditions to be met and the work.
2. Failure to comply with an inspection of the site shall not constitute ground for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work under this Division.

3. Review construction details of the existing portion of the building during the site inspection and include all work required to modify the existing plumbing installations and install new materials, comprising a part of the plumbing installation, within the present structure.
4. Review all construction details of the new portion of the building as illustrated on the architectural and structural drawings and be guided thereby.

B. Products and Materials Description

1. Where two or more units of the same kind or class of a specific item are required, these shall be the products of a single manufacturer; however, the component parts of the item need not be the products of one manufacturer.
2. In describing the various products and materials, in general each item will be described singularly, even though there may be a multiplicity of identical items. Also, where the description is only general in nature, exact sizes, duties, space arrangements, horsepower requirements and other data shall be determined by reference to the Documents.

C. The Work shall include modifications and extensions to existing systems, and the modification of the existing structure as required accommodating the installation of the Work.

D. Refer to other Divisions of the Specifications for related Work.

E. Contractor shall install, hang, support, etc. all MEP systems and equipment to satisfy all requirements of the applicable seismic zone using performance requirements and design criteria for project site as indicated by architect.

F. It is the intent, unless otherwise indicated, that all products and materials described and specified under this Division, shall be provided for a complete working system irrespective of use of the phrases "install", "furnish", "furnish and install", or "provide" as described above has been actually included.

G. The Contractor shall be responsible for all Work of every description in connection with this Division of the Specifications.

H. The Contractor shall specifically and distinctly assume, and does so assume, all risk for damage or injury from whatever cause to property or person used or employed on or in connection with this Work and of all damages or injury to any person or property wherever located, resulting from an action or operation under the Contract in connection with the Work, and undertake the promise to defend the Owner against all claims on account of any such damage or injury.

I. The Contractor will be held responsible for the satisfactory execution and completion of the Work in accordance with the true intent of the Documents.

J. The Contractor shall provide without extra charge all incidental items required as part of the Work, even though it may not be specifically indicated. If the Contractor has reason for objecting to the use of any material, equipment, device or method of construction as indicated, he shall make report of such objections to the Owner's Representative, obtain proper approval and adjustment to the Contract, and shall proceed with the Work.

K. Electric wiring

1. All electric wiring shall be installed under Division 26, except for such equipment items as are prewired at their point of manufacture and so delivered to the project, and except for the following:

a. Temperature Control Wiring and Power Wiring provided by controls contractor.

2. Prepare and submit for review wiring diagrams for all equipment furnished under this Division. Show on these diagrams all power, interlock, and control circuits. When the Architect takes no exception to these drawings, they shall become installation drawings for the Contractor.
3. All domestic cold and hot water piping shall be heat traced when routed external to the building or in areas susceptible to freezing conditions.

1.6 ORDINANCES, PERMITS AND CODES

A. It shall be the Contractor's duty to perform the work and provide the materials covered by these specifications in conformance with all ordinances and regulations of all authorities having jurisdiction.

B. All work herein shall conform to all applicable laws, ordinances, and regulations of the local utility companies.

C. The work shall be in accordance with, but not limited to, the requirements of:

1. National Fire Protection Association
2. National Safety Code
3. City of Torrington Building Codes
4. Wyoming Safety Code
5. Wyoming Boiler Code
6. Wyoming Department Of State Health Services

D. Codes and standards referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings, and specifications govern.

E. The Contractor shall obtain permits, plan checks, connection and specification fees, inspections, and approvals applicable to the Work as required by the regulatory authorities.

F. Fees and costs of any nature whatsoever incidental to permits, inspections, and approvals shall be assumed and paid by the Contractor.

G. The pro-rata costs, if any, for utilities serving this property will be paid for by the Owner and shall not be included as part of this Contract.

1.7 REFERENCE STANDARDS

A. Where differences between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents occur, the most stringent shall govern. The Contractor shall promptly notify the Owner's Representative in writing of any such difference.

B. Should the Contractor perform any Work that does not comply with local codes, laws and ordinances, industry standards or other governing regulations, the Work shall be corrected on non-compliance deficiencies with the Contractor bearing all costs.

C. In addition to the aforementioned ordinances, industry standards published by the following organizations shall apply:

1. AIA AMERICAN INSTITUTE OF ARCHITECTS
2. AASHO AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS
3. ACI AMERICAN CONCRETE INSTITUTE
4. AGA AMERICAN GAS ASSOCIATION
5. AISC AMERICAN INSTITUTE OF STEEL CONSTRUCTION
6. ANSI AMERICAN NATIONAL STANDARDS INSTITUTE
7. API AMERICAN PETROLEUM INSTITUTE
8. ARI AIR CONDITIONING & REFRIGERATION INSTITUTE
9. ASHRAE AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONS ENGINEERS, INC.
10. ASME AMERICAN SOCIETY OF MECHANICAL ENGINEERS
11. ASTM AMERICAN SOCIETY FOR TESTING AND MATERIALS
12. AWSC AMERICAN WELDING SOCIETY CODE
13. AWWA AMERICAN WATER WORKS ASSOCIATION
14. CISPI CAST IRON SOIL PIPE INSTITUTE
15. ASPE AMERICAN SOCIETY OF PLUMBING ENGINEERS
16. FM FACTORY MUTUAL
17. IRI INDUSTRIAL RISK INSURERS
18. NBS NATIONAL BUREAU OF STANDARDS
19. NFPA NATIONAL FIRE PROTECTION ASSOCIATION
20. PDI PLUMBING AND DRAINAGE INSTITUTE
21. UL UNDERWRITER'S LABORATORIES

D. Where the Contract Documents exceed the above requirements, the Contract Documents shall govern. In no case shall Work be installed contrary to or below the minimum legal standards.

1.8 DRAWINGS AND SPECIFICATIONS

A. The inter-relation of the specifications, the drawings, and the schedules are as follows:

1. The specifications provide the written requirements for the quality, standard, nature of the materials, equipment and construction systems.
2. The drawings establish the quantities, approximate dimensions, details and location of equipment.
3. The schedules give the capacities, characteristics and components.

B. For any individual project, if there is conflict between the drawings and or specifications, they are equivalent in authority and priority. Should they disagree in themselves, or with each other, prices shall be based on the most expensive combination of quality and quantity of work indicated. In the event of the above mentioned disagreements the resolution shall be determined by the Architect.

C. Contractor is responsible to bring any conflicts in drawings and/or specifications to the attention of the Architect, immediately, prior to any work being done.

D. Where the specifications do not fully agree with the schedules, the schedules shall govern. Figures given on drawings govern scale measurements and large scale details govern small scale drawings.

E. Review all construction details illustrated on the architectural and structural drawings and be guided thereby.

1.9 SUBMITTAL PROCEDURES

A. Common Requirements for Product Data: Where this Section and other Sections of this Division require Product Data to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Submit hardcopy of Product Data in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of product data submittals shall be bound materials as defined above. Separate products under distinct subheadings that correspond to paragraphs in specification text. Divide sections in binder with labeled divider tabs.
2. In addition to hardcopies required by Division 01, submit one copy of product data in electronic format. All files on disc shall be in Portable Document Format (.pdf).
3. Product Data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.

B. Product Data: For the following:

1. Dielectric fittings.
2. Mechanical sleeve seals.
3. Escutcheons.

C. Common Requirements for Shop Drawings: Where this Section and other Sections of this Division require Shop Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Prepare Shop Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®.
2. Submit hardcopy of Shop Drawings in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of Shop Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format. Files shall be include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
4. Shop Drawings shall be of appropriate scale based on the following:

   a. Piping Systems, including all underfloor work: Minimum 1/8" = 1'-0".
   b. Mechanical rooms: 1/4" = 1' – 0".

5. Shop drawings shall include the following items:

   a. Concrete pads and foundations.
   b. Equipment room layouts with actual dimensions and offsets for all systems.
   c. Roof layouts.
   d. Trench locations and sizes.
   e. Dimensioned floor drain locations.

D. Common Requirements for Coordination Drawings: Where this Section and other Sections of this Division require Coordination Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" and Division 01 Section "Project Management and Coordination". In addition to the requirements of Division 01 comply with the following:

1. Prepare Coordination Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®. Drawings files must be composite with multiple distinctive layers for each of the various trades.
2. Submit hardcopy of Coordination Drawings in the quantity as required under Division 01. Hardcopies of Coordination Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format. Files shall be include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
4. Coordination Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.
5. Coordination Drawings shall be multi-color prints with each system printed in a separate and unique color.

E. Coordination Drawings: Prepare drawings showing dimensioned layout for the following:

1. Penetration and Structural Opening: Floor plans showing sleeves and formed structural penetrations. Show sleeve and formed penetration layouts and relationships between structural components and other adjacent building elements, including but not limited to pre-tensioning and post-tensioning members where used.
2. Shop drawings shall be provided for the following:
    1) Sheet Metal and Duct Systems, including all underfloor work (prepared at a minimum scale of 1/8"=1'-0")
    2) Piping and equipment systems for storm, domestic water, waste and vent and other plumbing piping systems. (Preferably at 1/4" = 1' – 0" and not less than 1/8" = 1' – 0").
    3) Equipment room layouts with actual equipment, piping, and duct at 1/4" = 1' – 0" scale. Show clearances, access spaces, relative heights of piping.
    4) Housekeeping and equipment concrete pads.
    5) Dimensioned floor drain locations and the equipment each serves.
    6) Roof layouts.
    7) Trench locations and sizes.

    b. Equipment support locations, type of support, and weight on each support.
    c. Location of structural supports for structure-supported raceways.
    d. For floor mounted equipment: concrete base dimension, outline of equipment, and required clearances.
    e. Location of structural supports for seismic bracing.

F. Common Requirements for Specification Compliance Certification: Where this Section and other Sections of this Division require Specification Compliance Certification to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" for "Other Informational Submittals". In addition to the requirements of Division 01 comply with the following:

1. Prepare a line-by-line Specification Compliance Certification by marking up a copy of the Contract Document specification section in the left margin. Accompany the markup with a written report explaining all items that are not marked with "Compliance". Submit line-by-line markup, written report of deviations and alternates and a cover letter certified by Manufacturer or Installer that prepared the Specification Compliance Certification. Use the following key for preparing the line-by-line markup.

a. "C" for Compliance: By noting the term "compliance" or "C" in the margin, it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
b. "D" for Deviation: By noting the term "deviation" or "D" in the margin, it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified.
c. "A" for Alternate: By noting the term "alternate" or "A" in the margin, it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner.
d. "N/A" for Not Applicable: By noting the term "not applicable" or "N/A" in the margin, it shall be understood that the specified item is not applicable to the project.

G. Common Requirements For Qualification Data:

1. Professional Engineer Qualifications: Where this Section and other Sections of this Division require a Professional Engineer to be responsible for Delegated Design requirements; Submit Qualification data for Professional Engineer including, but not limited to, proof of registration in the Project location.
2. Independent Testing and Inspecting Agency Certification: Where this Section and other Sections of this Division require an Independent Testing and Inspecting agency to be responsible for Acceptance Testing and Field Quality Control requirements; Submit certification documentation for such agency that demonstrates compliance with the Quality Assurance paragraph of this Section.

H. Qualification Data: For Independent Testing and Inspecting Agency.

I. Welding certificates.

1.10 SUBSTITUTIONS

A. Where the product of a single manufacturer is mentioned by trade name or manufacturer's name in this Division, it is the only acceptable manufacturer.

B. Where two or more manufacturers are named, only those manufacturers will be considered or approved.

C. Manufacturers not listed will be considered for substitution prior to bid only. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum ten (10) business days prior to bid with each sub-paragraph noted with the comment, "compliance", "deviation", "alternate" or "not applicable". In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.

1. By noting the term "compliance" or "C", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
2. By noting the term "deviation" or "D", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
3. By noting the term "alternate" or "A", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the manufacturer proposes to provide.
4. By noting the term "not applicable" or "N/A", it shall be understood that the specified item is not applicable to the project.

D. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not.

E. Any product or material offered in substitution which differs in dimension or configuration from the Documents, the Contractor shall provide as part of the submittal a drawing, minimum 1/4" = 1'-0" scale, showing that the substitution can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.

F. Where substitute products or materials requiring different arrangement or connections from that indicated is accepted by the Owner's Representative, install the equipment or devices to operate properly and in harmony with the intent of the Documents, making all incidental changes in piping or wiring resulting from the substitution without any additional cost to the Owner.

G. The Contractor shall pay all additional costs incurred by other portions of the work in connection with all substitutions.

H. The Owner's Representative reserves the right to call for samples of any item of product or material offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.

I. When any request for a substitution of a product or material is submitted and rejected, the item named in the Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

1.11 QUALITY ASSURANCE

A. All Work shall be performed by properly licensed technicians skilled in their respective trades. All materials, equipment and devices shall be installed in accordance with the recommendations of the manufacturer and in the best standard practice to bring about results of a first class condition.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. Electrical Characteristics for Plumbing Equipment:

1. Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
2. Where variable frequency drives are provided for equipment, whether installed separately or integral to the equipment, the VFDs shall conform to Division 26 section, "Variable Frequency Motor Controllers".

E. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided on this project shall meet the requirements of the UL standard in every way, and shall be UL listed and labeled.

F. Products and materials shall be of the best quality customarily applied in quality commercial practice, and shall be by reputable manufacturers.

G. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.

H. Products and materials provided under this Division of the Specifications shall be essentially the standard item, unless otherwise noted, of the specified manufacturer, or where allowed, an alternate manufacturer.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver products and materials with factory-applied end caps or "heat shrink" wrappings to protect openings. Maintain opening protection through shipping, storage, and handling to prevent damage and the entrance of dirt, debris, and moisture.

B. Store light sensitive products and materials away from and protected against direct sunlight.

C. Support products and materials at all times to prevent sagging and bending.

D. The area provided for product and material storage at the jobsite shall be clean, dry and exposure to dust minimized.

E. Responsibility for the protection of products and materials shall extend to existing equipment, systems, and products and materials. Erect temporary sheltering structures, provide temporary bracing and supports, or cover existing equipment, systems, and products and materials to prevent damage and the entrance of dirt, debris, and moisture.

F. Failure on the part of the Contractor to comply with the above to the satisfaction of the Architect, Engineer, or either's authorized representative shall be sufficient cause for the rejection of products and materials in question.

1.13 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces.

D. Installation Drawings

1. Prepare special drawings as called for elsewhere herein or directed by the Architect to coordinate this work with the work of other Divisions, to illustrate changes in this work to facilitate its concealment in finished spaces, to avoid obstructions, or to illustrate the installation of a substitute equipment item.

2. Use these drawings in the field for the installation of the work. Unless otherwise directed, do not submit these drawings for review, but provide 3 copies to the Architect for information.

E. Schedule And Sequence Of Work

1. The Contractor shall meet and cooperate with the Owner and Owner's Representative to schedule and sequence Work so as to ensure meeting scheduled completion dates and avoid delaying other portions of the Work. Work requiring special sequencing shall be at no additional cost to the Owner and shall have no impact on the schedule.
2. Work schedules and completion dates as established shall be rigidly adhered to. Cooperate in establishing these schedules and perform the work under this Division at such times as directed so as to ensure meeting scheduled dates and avoid delaying any other Contractor.
3. The facility will continue to be in use throughout the construction period, and the schedule contemplates working in designated areas in the present facility while other adjacent areas are occupied. Execute work in this Division to minimize disturbance to occupants in adjacent areas.
4. When any work affects any services to any occupied area new permanent or temporary services, or a combination of both, shall be installed to enable occupied areas to function properly. Additional valves required shall be installed without added cost to the Owner.
5. Perform no work in the present facility that interferes with normal hours of occupancy, unless special permission is granted by the Owner. Included are operations which would cause objectionable noise or service interruptions. Each discipline shall coordinate their work with the established phases of construction.
6. Any work involving a service suspension shall be scheduled in advance with the Owner.
7. Should it be necessary to perform certain operations on an "overtime" basis in order not to interrupt the normal usage of the facility, include the costs of such overtime without change in the Contract amount.
8. The Contractor shall be responsible for coordinating the demolition and tie-in of the central plant system with the Owner and construction manager.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

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

### 2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. All piping and tubing shall be American manufactured, unless otherwise indicated.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F 493.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

D. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Innerlinx by Mason Dallas.
b. Metraflex Co.
c. Linkseal by Thunderline.

2. Sealing Elements: EPDM for high temperature applications and NBR for all others unless otherwise indicated, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 10, galvanized, plain ends.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated and rough brass, pending approval by Architect.

C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated and rough brass, pending approval by Architect.

D. One-Piece, Floor-Plate Type: Cast-iron floor plate.

E. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

A. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 SALVAGED MATERIALS

A. Reuse no salvaged material except as noted on the Drawings, specified herein, or directed by the Architect. Remove from the premises all present materials falling under this Division, which are removed from the existing building. Upon completion, leave no "dead" line or equipment installed in any portion of the area being remodeled.

3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons, after Architect's final approval of finish, for penetrations of walls, ceilings, and floors according to the following:

1. New piping penetrations shall be one-piece escutcheons.
2. Existing piping penetrations shall be two-piece escutcheons.
3. All sleeved penetrations shall be deep-drawn to allow flush installation between escutcheon and finished surface.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level to prevent water entrance to the sleeved hole. Vertical pipe supports must be extended to and supported by the floor and not the sleeve.
b. Provide concrete pipe curb in floors of mechanical equipment areas or other wet areas 4 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
   b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

      1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

N. Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter for above ground locations.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter for above ground and all underground locations.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

## 3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. 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.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic 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. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

K. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

A. 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. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Equipment called for on the plans and not listed herein shall be provided as though it were fully described herein.

B. Equipment called for herein shall be completely provided, whether fully detailed or not on the plans, and/or scheduled.

C. All equipment as indicated on the plans and as described herein shall be installed per manufacturer's recommendations to allow for proper operation and maintenance of the equipment.

D. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

E. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

F. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

G. Where any piece of equipment is too large for ingress through normal building openings, it shall be placed in its containing space before the enclosing structure is completed.

H. Install equipment to allow right of way for piping installed at required slope.

3.7 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 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 not less than 4 inches larger in both directions than supported unit.
2. Concrete bases for all equipment shall be 4 inches (100 mm) tall above finished floor.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.10 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.11 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.12 INSTALLATION, INSPECTIONS AND CERTIFICATIONS

A. The Contractor shall obtain timely inspections of the installation by the constituted authorities. Remedy any deficiencies to the satisfaction of the inspecting authority.

B. Upon final completion of the work, obtain certificates of acceptance from the constituted authorities. Deliver the certificates to the Architect for transmission to the Owner.

3.13 OPERATION PRIOR TO COMPLETION

A. When any piece of mechanical or electrical equipment is operable and it is to the advantage of the contractor to operate the equipment, he may do so with permission of Owner, providing that he properly supervises the operation, retains full responsibility for the equipment operated, and protects against dirt accumulations during operation. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner or until final acceptance by the Owner.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, and properly adjust the operation of the equipment before final acceptance by the Owner.

3.14 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers and/or technicians acceptable to the Owner's Representative to instruct other representatives of the Owner in the complete and detailed operation of each item of equipment or device of all the various electrical systems. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results.

B. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

C. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given the Owner's personnel and the letter of release acknowledged.

D. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals.

E. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturer's operating and maintenance instructions, parts lists (with sources identified), and other data as appropriate for each system.

3.15 SEALANT

A. Apply sealant to penetrations of all floor and wall assemblies to maintain pressure differentials required by AIA and DSHS for all pressure sensitive rooms including: Isolation rooms, Protective Environment rooms, Operating rooms, C-section rooms, and Pharmacy including Chemo Prep, Sterile Prep and Ante rooms. Sealant materials and installation requirements are specified in Division 07 Section "Joint Sealants" and Division 09 Section "Gypsum Board Assemblies.

END OF SECTION 220500

# PART 1 - GENERAL

## 1.1 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gages.
3. Test plugs.

B. Related Sections:

1. Division 22 Section "Domestic Water Piping" for domestic and fire-protection water service meters inside the building.
2. Division 23 Section "Facility Natural-Gas Piping" for gas meters.

## 1.2 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

## 1.3 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.

C. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.

# PART 2 - PRODUCTS

## 2.1 THERMOMETERS

A. Digital Vari-angle Thermometer, self-powered and within 1% accuracy, Weiss Model DVU35.

1. Case: Hi-impact ABS
2. Range: -40/300 °F (-40/150 °C)
3. Display: 3/8" LCD digits, wide ambient formula
4. Accuracy: 1% of reading or 1° whichever is greater
5. Resolution: 1/10° between -19.9/199.9 °F (-28/93 °C)
6. Recalibration: Internal potentiometer
7. Lux Rating: 10 Lux (one foot-candle)
8. Update Rate: 10 seconds
9. Ambient Operating Range: -30/140 °F (-35/60 °C)
10. Ambient Temp. Error: Zero
11. Humidity: 100%
12. Sensor: Glass passivated thermistor
13. Connector: adjustable angle

2.2 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, socket-type 304 stainless steel fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.3 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ernst Gage Co.
2. Miljoco Corp.
3. Trerice, H. O. Co.
4. Weiss Instruments, Inc.
5. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
6. Dwyer Instruments, Inc.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Liquid-filled type, stainless steel, 4-1/2" diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or Black metal.
7. Window: Glass.
8. Ring: Stainless steel.
9. Accuracy: Grade B, plus or minus 2 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 50 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel ball type.
2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.
3. Syphons: NPS 1/4 coil of brass tubing with threaded ends.

2.4 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
7. Watts Industries, Inc.; Water Products Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for water service at 20 to 200 deg F shall be CR.
2. Insert material for water service at minus 30 to plus 275 deg F shall be EPDM.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install digital thermometers in the following locations:

1. Inlet and outlet of each domestic water heater.
2. Inlet and outlet of each thermostatic mixing valve.

B. Install thermometers in separable sockets at each additional location indicated on the Drawings or specified elsewhere herein.

C. Provide the following temperature ranges for thermometers:

1. Domestic Hot Water: 30 to 200 deg F, with 2-degree scale divisions.
2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.

3.2 GAGE COCK APPLICATIONS

A. Install test plugs adjacent to all control sensors (except Insertion Type Flow Meters) installed in piping systems.

B. Valved pressure gage connections shall be installed in each location indicated on the Drawings and/or specified elsewhere herein.

C. Install each gage cock on a nipple of sufficient length so that the cock handle will be free of the pipe insulation. Position each cock so that a 4-1/2" diameter dial gage may be easily read and screwed into and out of the cock.

D. On pumps use a single pressure gage connected by ball valves and metal tubing to the inlet and discharge flanges as well as the suction diffuser inlet flange, if applicable.

E. Install gage cocks at each pump as close to pump suction and discharge connections as practicable. Use any gage connections provided in the pump casing.

3.3 GAGE APPLICATIONS

A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.

B. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

C. Furnish and install calibrated pressure gauges at each location indicated on the Drawings, specified elsewhere herein, and/or as a standard.

3.4 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.

C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

D. Install ball-valve and snubber or syphon fitting in piping for each pressure gage.

E. Install test plugs in tees in piping.

F. Install connection fittings for attachment to portable indicators in accessible locations.

G. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.

H. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION 220519

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following general-duty valves:

1. Copper-alloy ball valves.
2. Ferrous-alloy ball valves.
3. Ductile-iron butterfly valves.
4. High-pressure butterfly valves.
5. Bronze check valves.
6. Cast-iron swing check valves.
7. Spring-loaded, lift-disc check valves.
8. Chainwheel actuators.

B. Related Sections include the following:

1. Division 21 fire-suppression piping and fire pump Sections for fire-protection valves.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and charts.
3. Division 22 piping Sections for specialty valves applicable to those Sections only.
4. Division 23 "Facility Natural Gas Piping" for natural gas valves.

## 1.2 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. TFE: Tetrafluoroethylene plastic.
6. NRS: Nonrising stem.
7. OS&Y: Outside screw and yoke.

## 1.3 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; furnished specialties; and accessories.

## 1.4 QUALITY ASSURANCE

A. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

B. NSF Compliance: NSF 61-G for valve materials for potable-water service.

C. Bronze valves shall be made with dezincification-resistant materials. All valves shall comply with the current edition of recognized industry standards for design, materials and testing. These standards include but are not limited to MSS SP-80 and MSS SP-110.

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 ball and plug valves open to minimize exposure of functional surfaces.
4. Set butterfly valves closed or slightly open.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

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 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 and larger with flanged or grooved ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:

1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Gear Drive: For quarter-turn valves NPS 8 and larger.
3. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

G. Extended Valve Stems: On insulated valves. Valves shall have 2-inch (50-mm) stem extensions and the following features:

1. Ball Valves: Shall have extended operating handle of non-thermal-conductive material, protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation, and memory stops that are fully adjustable after insulation is applied.

    1) NIBCO Nib-seal handle extension
    2) Conbraco Industries, Inc.; Apollo Div.
    3) Jamesbury, Inc.
    4) Kitz Insulated Stem Extension Model #ISE 1 thru 4
    5) Milwaukee Valve: The Insulator/MS

2. Butterfly Valves: Shall have extended necks.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

I. Valve Grooved Ends: AWWA C606.

J. Solder Joint: With sockets according to ASME B16.18.

1. Caution: Use solder with melting point below 840 deg F for check valves; below 421 deg F for ball valves.

K. Threaded: With threads according to ASME B1.20.1.

L. Valve Bypass and Drain Connections: MSS SP-45.

2.2 COPPER-ALLOY BALL VALVES

A. Brass Ball Valves, General: MSS SP-110 and have a brass body complying with ASTM B 283.

B. Bronze Ball Valves, General: MSS SP-110 and have a copper alloy body complying with ASTM B 584, except for Class 250 which shall comply with ASTM B 61, full-depth ASME B1.20.1 threaded or solder or press connection ends, and blowout-proof stems.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: Chrome-plated bronze ball and bronze stem and; reinforced TFE seats; threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, solder or threaded or press connection ends; and 150 psig SWP 600-psigCWP rating.

1. NIBCO Model S-585-80-LF or T-585-80-LF
2. Conbraco Industries, Inc.; Apollo 77CALF
3. Crane Co.
4. Watts Model

5. Kitz Model 868 or 869
6. Milwaukee UPBA450 or UPBA400
7. Hammond UP8311A or UP88301A

D. Two-Piece, Full-Port, Copper-alloy Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel vented ball and stem, reinforced TFE seats, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, soldered or threaded or press connection ends; 150 psig SWP and 600-psig CWP ratings.

1. NIBCO Model S-585-66-LF or T-585-66-LF
2. Conbraco Industries, Inc.; Apollo 77CALF
3. Crane Co. Model
4. Watts Model

5. Kitz Model 868M or 896M
6. Milwaukee UPBA400S, UPBA450S
7. Hammond UP8303A, UP8313A

E. Three-Piece, Full Port, Copper-alloy Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel vented ball and stem, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, stainless nuts and bolts on valve body, soldered or threaded or press connection ends; 150 psig SWP and 600-psig CWP rating.

1. NIBCO Model S-595-Y-66-LF or T-595-Y-66-LF
2. Conbraco Industries, Inc.; Apollo 82LF
3. Crane Co.

4. Kitz Model 862M or 863M
5. Milwaukee UPBA350S, UPBA300S
6. Hammond UP8613, UP8603

2.3 BRONZE BUTTERFLY VALVES

A. Bronze Butterfly Valves, General: CTS 2 (DN50) – 8 (DN300), 300-psig CWP rating with offset, aluminum-bronze disc and bronze cast body. Bubble tight bi-directional and dead-end service at full rated pressure.

1. Victaulic Company Style 608N

2.4 DUCTILE or CAST IRON BUTTERFLY VALVES

A. Butterfly Valves, General: MSS SP-67, for bubble-tight shutoff, extended-neck for insulation, disc and lining suitable for potable water, unless otherwise indicated, and with the following features:

1. Full lug, grooved and flanged valves shall be suitable for bi-directional dead end service at full rated pressure without the use or need of a downstream flange. Valves NPS 12 and smaller shall not have exposed stem to disc fasteners and no exterior mounted fasteners to hold the liner.
2. Valve sizes NPS 2 through NPS 6 shall have lever lock operator; valve sizes NPS 8 and larger shall have weatherproof gear operator.

B. Class 150: 175-psig CWP Rating, Aluminum-Bronze Disc, EPDM Seat, Ferrous-Alloy Butterfly Valves: Full-lug type with ductile-iron body, one- or two-piece Type 400 series stainless-steel stem, bronze bushing, aluminum-bronze disc, and phenolic-backed EPDM seat (liner) attached to the body.

1. NIBCO Model LD-1000
2. Cooper Cameron Corp. Model NF-*C (238 Series)* 511435-A
3. DeZURIK; SPX Corporation Model BRS *Series* BHP, (*Size),*LD-DI-EPDM-EPDM-BZ-S4-*
4. Conbraco Industries, Inc; Apollo LC-149

5. Kitz Model #6123E
6. Crane

7. Milwaukee ML333E
8. Hammond 6411
9. Grinnell

C. Class 200: 200-psig CWP Rating, Aluminum-Bronze Disc, EPDM Seat, Ferrous-Alloy Butterfly Valves: Full-lug type with ductile-iron body, one-piece Type 400 series stainless-steel stem, copper bushing, fasteners and pins shall not be used to attach stem, to disc, no pins or fasteners in waterway, aluminum-bronze disc, and molded-in EPDM seat (liner).

1. NIBCO Model LD-2000
2. Cooper Cameron Corp. Model NF-C *(221Series*) 511435-*
3. DeZURIK; SPX Corporation Model BRS *(Size)* LD-DI-EPDM-EPDM-BZ-S4-*
4. Conbraco Industries, Inc; Apollo LD-141

5. Kitz Model #6123E
6. Crane
7. Milwaukee ML333E
8. Hammond 6411
9. Grinnell

D. Grooved-End, Ferrous-Alloy Butterfly Valves with EPDM-Encapsulated Ductile-Iron Disc or electroless nickel coated ductile iron disc with EPDM seal, Ductile-iron body or stainless steel body with grooved ends, polyamide coating inside and outside or alkyd enamel inside and outside, two-piece Type 416 stainless-steel stem, PTFE bronze sintered on steel bushing or TFE lined fiberglass and brass bushing, fasteners and pins shall not be used to attach stem to disc, no pins or fasteners in waterway, and 300-psig CWP Rating for Valves NPS 2 through NPS 8, 200 psig CWP Rating for Valves NPS 10 through NPS 12.

1. NIBCO Model GD-4765
2. Victaulic Co. of America. Model Vic-300-Master Seal Style 361 or Style 461.

## 2.5 CARBON STEEL HIGH-PRESSURE BUTTERFLY VALVES

A. High-Pressure Butterfly Valves, General: MSS SP-68 API 609 seat pressure and temperature ratings, ANSI B1634A body pressure and temperature ratings, ANSI B16.5 flange dimensions, ISO 5211, EN 12116 actuator mounting top works, capable of bi-directional dead-end service at full-rated pressure without use of downstream flange, carbon-steel body, offset design, extended-neck for insulation, permanently lubricated 300-series stainless-steel bushings with graphite and modified PTFE seats, graphite packing and gasket, one-piece duplex stainless-steel stem, and stainless-steel disc. Valves NPS 6 and smaller shall have lever-lock operator; valves NPS 8 and larger shall have weatherproof gear operator.

B. Class 150, Full-Lug, 285 psig CWP Rating, High-Pressure Butterfly Valves:

1. NIBCO Model LCS6822
2. Jamesbury, Inc. Model *(Size)* 815L-11-22-36-TT-*
3. WKM Model *(Size)* Model B 113-05-SO1-11-*
4. Conbraco Industries, Inc; Apollo Series 215 HPBFV
5. Milwaukee HP1LCS
6. Hammond HP1LCS

## 2.6 BRONZE CHECK VALVES

A. Bronze Check Valves, General: MSS SP-80.

B. Class 125, Bronze, Lift Check Valves with TFE Disc: ASTM B-584 bronze body and integral seat with soldered or threaded end connections, and having 250-psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. Kitz Model 836 or 826
3. NIBCO Model S-480-Y-LF or T-480-Y-LF
4. Conbraco Industries, Inc; Apollo Model 61
5. Powell, Wm. Co.
6. Milwaukee UP1548T, UP548T
7. Hammond UP947, UP943

C. Class 125, Bronze, Swing Check Valves with TFE Disc: ASTM B-62 bronze body and seat with TFE disc in bronze seat holder, Y-pattern design, soldered or threaded end connections, and having 200 psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. Kitz Model 822T or 823T
3. NIBCO Model S-413-Y-LF or T-413-Y-LF
4. Conbraco Industries, Inc; Apollo 163S or 163T
5. Powell, Wm. Co.
6. Milwaukee UP1509, UP509
7. Hammond UP912, UP904

D. Class 150, Bronze, Swing Check Valves with TFE Disc: ASTM B-62 bronze body and seat with TFE disc in bronze seat holder, Y-pattern design, soldered or threaded end connections, and having 300 psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. Kitz #30T or #29T
3. NIBCO Model S-433-Y or T-433-Y
4. Conbraco Industries, Inc; Apollo 164T
5. Powell, Wm. Co.
6. Milwaukee 1510T, 510T
7. Hammond IB945

2.7 IRON SWING CHECK VALVES

A. Iron Swing Check Valves, General: MSS SP-71.

B. Class 125, Gray-Iron, Standard Swing Check Valves: ASTM A-126, Class B cast-iron body and bolted bonnet with flanged end connections; non-asbestos synthetic-fiber gaskets; bronze disc and seat; and having 200 psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. Kitz Model 78
3. NIBCO Model F-918-N
4. Conbraco Industries, Inc; Apollo 910F
5. Powell, Wm. Co.
6. Milwaukee F-2974-M
7. Hammond IR1126-HI

C. Grooved-End, Spring Assisted Check Valves: ASTM A536 Ductile-iron body with grooved ends, stainless steel spring and synthetic seats and having 250-psig CWP Rating.

1. Anvil International, Inc.
2. NIBCO Model G-917-W
3. Victaulic Co. of America

2.8 IRON SPRING-LOADED, LIFT-DISC CHECK VALVES

A. Lift-Disc Check Valves, General: FCI 74-1 and MIL-V-18436F, with spring-loaded, center-guided bronze disc and seat.

B. Class 125, Globe, Flanged Lift-Disc Check Valves: Globe style with cast-iron body and flanged ends, and having 200 psig CWP rating.

1. NIBCO Model F-910-B-LF
2. Metraflex Co.
3. Kitz Model 7022
4. Milwaukee 1800
5. Hammond IR9354

2.9 CHAINWHEEL ACTUATORS

A. Manufacturers:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries, Inc.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.
2. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
3. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

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

B. 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.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. 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.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or butterfly valves.
2. Throttling Service: Ball or butterfly valves.
3. Pump Discharge: Spring-loaded, lift-disc check valves.

B. If valves with specified CWP ratings are not available, the same types of valves with higher CWP ratings may be substituted.

C. Domestic Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two -piece, full port, stainless-steel trim, bronze.
2. Ball Valves, NPS 2-1/2 and Larger: Class 150, full port, ferrous alloy.
3. Butterfly Valves, NPS 2 to NPS 12 (DN 50 to DN 300): Single-flange, full lug, 200-psig CWP rating, bronze disc, EPDM liner, ductile iron.
4. Butterfly Valves, NPS 14 (DN 350) and Larger: Single-flange, full lug, 150-psig CWP rating, bronze disc, EPDM liner, ductile iron.
5. High-Pressure Butterfly Valves, NPS 2-1/2 (DN 65) and Smaller: Single-flange full lug, 285 psig (1964 kPa) CWP rating.
6. Grooved-End, Bronze Butterfly Valves, CTS 2 to 8 (DN 50 to DN 300): 300-psig (2070-kPa) CWP rating, EPDM-encapsulated aluminum-bronze or stainless steel disc.
7. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2 to NPS 8: 300-psig CWP rating, EPDM- encapsulated ductile-iron disc.
8. Grooved-End, Ductile-Iron Butterfly Valves, NPS 10 to NPS 12 250 to DN 300): 200-psig CWP rating, EPDM- encapsulated ductile-iron disc.
9. Lift Check Valves, NPS 2 and Smaller: Class 125, bronze with TFE disc.
10. Swing Check Valves, NPS 2 and Smaller: Class 150, bronze with TFE disc.
11. Swing Check Valves, NPS 2-1/2 and Larger: Class 125, cast-iron, standard.
12. Grooved-End Swing Check Valves, NPS 2-1/2 and Larger: Grooved-end, ductile-iron, swing check valves.
13. Spring-Loaded, Center-Guided, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Class 125, flanged end, iron.

D. Select valves, except wafer and flangeless types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded or press connection ends.
2. For Copper Tubing, NPS 2-1/2: Flanged ends.
3. For Grooved-End, Copper Tubing: Valve ends may be grooved.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install chainwheel operators on valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 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.

END OF SECTION 220523

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Fastener systems.
5. Pipe stands.
6. Pipe positioning systems.
7. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
3. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

## 1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

## 1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Pipe hangers and supports shall conform to the recommendations of ASHRAE, ASPE, ANSI, and MSS, unless otherwise indicated.

## 1.4 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.

5. Pipe positioning systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Fiberglass strut systems. Include Product Data for components.
4. Pipe stands. Include Product Data for components.
5. Equipment supports.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." AWS D1.4, "Structural Welding Code--Reinforcing Steel." ASME Boiler and Pressure Vessel Code: Section IX**.**

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.
15. Anvil International

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.
8. Anvil International

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 CUSHION CLAMPS FOR MEDICAL GAS

A. Clamps for trapeeze style hangers, designed to isolate copper medical gas piping from dissimilar metals.

B. Manufacturers:

1. Tolco Inc.
2. HOLDRITE Corp.; Hubbard Enterprises.

2.5 FASTENER SYSTEMS

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2.6 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Available Manufacturers:

a. ERICO/Caddy Pyramid
b. MIRO Industries.

C. Low-Type, Single-Pipe Stand: One-piece plastic or stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1. Available Manufacturers:

a. MIRO Industries.
b. Portable Pipe Hangers.
c. ERICO/Caddy Pyramid

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Available Manufacturers:

a. ERICO/Caddy Pyramid
b. MIRO Industries.
c. Portable Pipe Hangers.

2. Base: Plastic or Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Available Manufacturers:

a. Portable Pipe Hangers.

2. Bases: One or more plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

1. Available Manufacturers:

a. Pate.
b. Thy Curb.

1) Models:

a) TC-1 for insulated roof decks.
b) TC-2 for un-insulated and existing roof decks.
c) TC-3 for Bulb-T roof decks.

2. Pipe curbs and rails with covers shall be all welded 18 gauge galvanized steel shell and baseplate, wood nailer, and TP-1 Duro EPDM cover or TP-2 pipe cover, as detailed on the drawings, for pipe penetration(s).

2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corp.
2. HOLDRITE Corp.; Hubbard Enterprises.
3. Samco Stamping, Inc.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

1. Available Manufacturers:

a. Pate.
b. Thy Curb.

1) Models:

a) TEMS-1 for insulated roof decks.
b) TEMS-2 for un-insulated and existing roof decks.
c) TEMS-3 for single-ply roof systems.

2. Equipment supports shall be all welded 18 gauge galvanized steel shell, baseplate and counterflashing with internal bulkhead re-enforcement and wood nailer.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and non-metallic 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 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to proper placement of inserts, anchors and other building structural attachments.

3.2 HANGER AND SUPPORT APPLICATIONS

A. Use only one type hangers and supports, by one manufacturer, for each piping service.

B. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

C. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

D. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

E. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

F. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing or provide copper-plated hangers and supports for copper piping systems where hangers are in contact with bare pipe.

G. Use padded hangers for piping that is subject to scratching.

H. Horizontal-Piping Hangers and Supports, Select size of hangers and supports to exactly fit pipe size for bare piping, and around piping insulation with saddle or shield for insulated piping. Unless otherwise indicated and except as specified in piping system Sections, install the following types. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
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 2 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 20, 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: Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Select size of hanger rod attachments to suit hanger rods. 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: Select spring hangers and supports to suit pipe size and loading. 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 absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

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-102 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.3 MEDICAL GAS HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

B. Use cushion clamps on all medical gas piping

C. Vertical Piping: MSS Type 8 or 42, clamps.

D. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet and Less: MSS Type 1, adjustable, steel, clevis hangers.
2. Longer Than 100 Feet: MSS Type 43, adjustable, roller hangers.

E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.

F. Base of Vertical Piping: MSS Type 52, spring hangers.

G. Support horizontal piping within 12 inches of each fitting and coupling.

H. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4: 60 inches with 3/8-inch rod.
2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
3. NPS 3/4: 84 inches with 3/8-inch rod.
4. NPS 1: 96 inches with 3/8-inch rod.
5. NPS 1-1/4: 108 inches with 3/8-inch rod.

6. NPS 1-1/2: 10 feet with 3/8-inch rod.
7. NPS 2: 11 feet with 3/8-inch rod.
8. NPS 2-1/2: 13 feet with 1/2-inch rod.
9. NPS 3: 14 feet with 1/2-inch rod.
10. NPS 3-1/2: 15 feet with 1/2-inch rod.
11. NPS 4: 16 feet with 1/2-inch rod.
12. NPS 5: 18 feet with 1/2-inch rod.
13. NPS 6: 20 feet with 5/8-inch rod.
14. NPS 8: 23 feet with 3/4-inch rod.

J. Install supports for vertical copper tubing every 10 feet.

3.4 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required by the following table to properly support piping from building structure.

| Pipe Size (in) | Max. Hanger Spacing (ft) | Min. Rod Size (in) | Max. Alternate Hanger Spacing (ft) | Min. Alternate Rod Size (in) |
|---|---|---|---|---|
| 1/2 | 6 | 3/8 | -- | -- |
| 3/4 | 6 | 3/8 | -- | -- |
| 1 | 7 | 3/8 | -- | -- |
| 1-1/4 | 8 | 3/8 | -- | -- |
| 1-1/2 | 9 | 3/8 | -- | -- |
| 2 | 10 | 3/8 | -- | -- |
| 2-1/2 | 11 | 1/2 | -- | -- |
| 3 | 12 | 1/2 | 8 | 3/8 |
| 3-1/2 | 13 | 5/8 | 8 | 3/8 |
| 4 | 14 | 5/8 | 8 | 3/8 |
| 5 | 16 | 5/8 | 10 | 1/2 |
| 6 | 17 | 3/4 | 10 | 1/2 |
| 8 | 19 | 7/8 | 10 | 1/2 |
| 10 | 20 | 7/8 | 10 | 1/2 |
| 12 | 20 | 7/8 | 10 | 1/2 |
| 14 | 20 | 1 | 16 | 7/8 |
| 16 | 20 | 1-1/8 | 14 | 7/8 |
| 18 | 20 | 1-1/4 | 10 | 7/8 |
| 20 | 20 | 1-1/4 | 10 | 7/8 |
| 24 | 20 | 1-1/4 | 8 | 7/8 |

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

O. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating above 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 according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold 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:
5.
6. Pipes NPS 8 and Larger: Include wood inserts.
7. Insert Material: Length at least as long as protective shield.
8. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

## 3.5 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

## 3.6 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

## 3.7 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 inch

3.8 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections**.**

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Requirements for Manufacturer Seismic Certification.
2. Requirements for Manufacturer Special Seismic Certification.
3. Isolation pads.
4. Freestanding and restrained spring isolators.
5. Elastomeric hangers.
6. Spring hangers.
7. Spring hangers with vertical-limit stops.
8. Pipe riser resilient supports.
9. Resilient pipe guides.
10. Seismic snubbers.
11. Restraining braces and cables.
12. Steel and inertia, vibration isolation equipment bases.

B. Related Sections include the following:

1. Division 22 Section "Common Work Results for Plumbing"
2. Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment"

## 1.2 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

D. Seismic Certification: Seismic certification refers to a manufacturer's certification for architectural, mechanical, and electrical components, supports, and attachments pursuant to ASCE/SEI 7-05 Section 13.2.1.2.

E. Seismic Qualification: Same as Special Seismic Certification

F. Special Seismic Certification: Seismic certification of mechanical and electrical equipment based on ASCE/SEI 7-05 Section 13.2.2. Special Seismic Certification is required for active mechanical and electrical equipment that must remain operable following the design earthquake.

## 1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for vibration and seismic controls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Do not use more than one pre-approved seismic-force resistance system on any single run of pipe, duct or conduit. Mixing of multiple pre-approved systems is not acceptable.

B. Seismic-Restraint Loading: In preparation of Delegated Design, utilize seismic forces as described in ASCE 7-02 "Minimum Design Loads for Buildings and Other Structures" as published by the American Society of Civil Engineers, unless requirements in this Section are more stringent.

1. Site Class as Defined in the IBC: _.
2. Assigned Seismic Design Category as Defined in the IBC: D. (Bracing of non-structural elements is required.)

a. Component Importance Factor: 1.5.
b. Assign component factors based on ASCE-7 Table 13.6-1 for the following:

1) Component Response Modification Factor.
2) Component Amplification Factor.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second):

a. $S_S$ = 0.331g.
b. $S_{DS}$ = 0.339g.

4. Design Spectral Response Acceleration at 1-Second Period:

a. $S_1$ = 0.108g.
b. $S_{D1}$ = 0.171g.

C. Submittal Review Conference: At time of Delegated Design Shop Drawing submission, schedule a submittal review conference with the Architect and Structural Engineer-of-Record for the project. The purpose of this conference is to review attachment locations and insure supplementary framing that is needed to resist the loads, maintain stability or to meet other installation requirements of a pre-approved system have been accounted for in the Structural Engineer-of-Record's design.

1.4 SUBMITTALS

A. Product Data: For the following:

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 seismic-restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD, and an agency acceptable to authorities having jurisdiction.
b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

4. Seismic-Restraint Details:

   a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
   c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD, and an agency acceptable to authorities having jurisdiction showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings:

1. Show coordination of seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
2. Submit approval from Structural Engineer where supports connect directly to structure.

D. Welding certificates.

E. Common Requirements For Qualification Data:

1. Manufacturer Seismic Qualification Certification: Where this Section and other Sections of this Division require products to meet seismic requirements; Submit certification that equipment, devices, accessories, and components will withstand seismic forces defined in this Section. Include the following:

   a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

      1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

2. Manufacturer Special Seismic Certification: Where this Section and other Sections of this Division require products to meet seismic requirements; Submit certification that equipment, devices, accessories, and components will withstand seismic forces defined in this Section. Include the following:

   a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

      1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Qualification Data: For professional engineer and testing agency.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vibration Isolation and Control

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. ISAT

4. Kinetics Noise Control.
5. Korfund Company.
6. Mason Industries.
7. Vibration Eliminator Company.
8. Vibration Mountings & Controls, Inc.

B. Seismic Restraint

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.
4. ISAT
5. Kinetics Noise Control.
6. Korfund Company.
7. Mason Industries.
8. TOLCO Incorporated.
9. Unistrut; Tyco International, Ltd.

2.2 VIBRATION ISOLATORS

A. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

B. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: Minimum Kx/Ky (horizontal to vertical spring rate) of 1.0.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 100 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

C. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
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: Minimum Kx/Ky (horizontal to vertical spring rate) of 1.0.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

D. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

E. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. 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.
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: Minimum Kx/Ky (horizontal to vertical spring rate) of 1.0.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

F. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. 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.
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: Minimum Kx/Ky (horizontal to vertical spring rate) of 1.0.
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. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

G. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch-thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

H. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch-thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

## 2.3 VIBRATION ISOLATION EQUIPMENT BASES

A. Housekeeping Pads: 4" or 6" tall with 1" chamfer on all top edges.

B. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

   a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

   a. Include supports for suction and discharge elbows for pumps.
   b. The weight of each inertial block shall not be less than 150% of supported equipment.
   c. Extend block minimum 4" beyond equipment base.
   d. Chamfer edges minimum 1".

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

## 2.4 SEISMIC-RESTRAINT DEVICES

A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES, OSHPD, and an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

B. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized or ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener:

1. Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
2. Reinforcing steel angle clamped to hanger rod.

F. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

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 APPLICATIONS

A. Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, OSHPD, and an agency acceptable to authorities having jurisdiction.

B. Install hanger rod stiffeners to prevent buckling of hanger rods due to seismic forces.

C. Base: None.

1. Suspended Equipment:

a. Suspended Expansion Tanks.
b. Domestic hot water circ. Pumps.
c. Piping in Mechanical Rooms.

2. Isolator: Spring hanger with 2" deflection.

D. Base: Reinforced Concrete Inertia Block

1. Equipment: Pumping Systems

a. Fire.
b. Domestic water.

2. Isolator: Freestanding, open spring type with 1.5" deflection.

E. Base: 4" Housekeeping Pad

1. Equipment:

a. Floor mounted Reciprocating Air Compressors.

2. Isolator: Restrained, open spring type with 2" deflection.

F. Miscellaneous Systems

1. Jockey Pump

a. Base: 6" housekeeping pad.
b. Isolator: None.

2. Rotary, Centrifugal, and Screw Air Compressors

a. Base: 4" Housekeeping pad.
b. Isolator: Restrained, open spring type with 1" deflection.

## 3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches.
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, and an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, and an agency acceptable to authorities having jurisdiction providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

## 3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Domestic Water Piping" for piping flexible connections.

## 3.5 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. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of sprint isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 220518

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.
4. Valve tags.

## 1.2 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.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

## 1.3 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, laminated phenolic with a black surface and white substrate for mechanical engraving, 1/16 inch minimum thickness, beveled edges, 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: 1/2 inch. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number as directed by owner. Secondary lettering shall indicate date of installation.

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.

D. Punched plastic tape for labels is not acceptable.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction. Labels shall conform to ANSI A13.1 and the following table:

| **Outside Diameter of Pipe or of Covering** | **Height of Letters** |
|---|---|
| ¾" to 1-1/4" | ½" |
| 1-1/2" to 2" | ¾" |
| 2-1/2" to 6" | 1-1/4" |

B. Available Manufacturers: Seton, Brady, or Westline.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover or cover full circumference of pipe.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, and an arrow indicating flow direction. For steam systems, also include line pressure on label.

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.

2.3 DUCT LABELS

A. Material and Thickness: Multicolor, plastic labels having adhesive for attachment.

B. Service:

1. Non-hazardous

a. Supply
b. Return
c. Outside air
d. Relief
e. General Exhaust

2. Hazardous

a. Isolation Exhaust

C. Letter Color:

1. Non-hazardous Service: Black
2. Hazardous Service: Black

D. Background Color:

1. Non-hazardous Service: White
2. Hazardous Service: Orange

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content.

G. Minimum Letter Size: 2-1/2 inch for name of service.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with minimum 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 chain and S-hook or beaded chain.

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 FIRE DAMPERS AND SMOKE DAMPERS

A. Provide identification for all fire damper or smoke damper access openings.

B. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, acrylic enamel red unless otherwise indicated. Paint may be in pressurized spray-can form.

3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

C. Labels

1. A. Material and Thickness: Multilayer, multicolor, laminated phenolic with a red surface and white substrate for mechanical engraving, 1/16 inch (1.6 mm) minimum thickness, beveled edges, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Red.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1 inch (25.4 mm) for name of units. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

D. Fire Damper and Smoke Damper Stencil and Labels Contents

1. "FIRE DAMPER" or "SMOKE DAMPER" as appropriate for each device.

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 using fasteners or adhesives.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding:

1. Painting of piping is specified in Division 09 Section "High-Performance Coatings."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; accessible maintenance spaces such as shafts; 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 20 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
7. In no case shall a line enter or leave a room without being identified.
8. Secure identification markers to piping by firmly pressing markers in place, following removal of protective covering. Additionally secure by banding ends of markers in place using 1/2 inch wide aluminum bands of the type normally used to secure insulation in place.

3.4 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on the outermost surface of an installed air ducts system.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems except:

1. Check valves
2. Valves within factory-fabricated equipment.
3. Shutoff valves directly adjacent to equipment
4. Faucets
5. Convenience and lawn-watering hose connections
6. HVAC terminal devices

B. Emergency shut-off valves: Provide permanent equipment label with minimum 1" high lettering. These valves include valves 2" and larger for the following services:

1. Domestic cold water.
2. Domestic hot water.
3. Chilled water.
4. Heating water.

C. Mark ceiling grid with colored markerin style and material as required by Owner indicating valve locations above ceiling.

D. List tagged valves in a valve schedule and provide to Owner with floor plans indicating location.

3.6 FIRE DAMPER AND SMOKE DAMPER LABEL INSTALLATION

A. Stencil the words "FIRE DAMPER" or "SMOKE DAMPER" on access doors that are in sheet metal ducts. Ensure overspray of stencil medium is cleaned, removed, or covered from adjacent piping, walls, and as otherwise indicated.

B. Install tags on access doors that are in walls or ceilings where such doors conceal fire damper access plates, or on the T-bars of removable ceilings immediately below the location of fire damper access openings above.

END OF SECTION 230553

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:

   a. Calcium silicate.
   b. Cellular glass.
   c. Fiberglass.
   d. Flexible elastomeric.

2. Factory-applied jackets.
3. Field-applied cloths.
4. Field-applied jackets.
5. Adhesives.
6. Mastics.
7. Sealants.
8. Tapes.
9. Securements.
10. Thermal Hanger-Shield Inserts

## 1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Calculations: For insulation submitted outside of the conductivity range per the "Minimum Pipe Insulation Thickness" Table for the application listed, submit thickness calculations.

C. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Sample Sizes:

   a. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.

b. Sheet Form Insulation Materials: 12 inches square.
c. Jacket Materials for Pipe: 12 inches long by NPS 2.
d. Sheet Jacket Materials: 12 inches square.
e. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

E. Qualification Data: For qualified Installer.

F. 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.

G. Field quality-control reports.

1.3 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. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

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.

1.4 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.

1.5 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.6 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 Manufacturers:

A. Fiberglass

1. Johns-Manville.
2. K-Flex.
3. Knauf Fiberglass.
4. Manson (Certain Teed).
5. Owens-Corning.
6. Pittsburg-Corning.

B. Flexible Elastomeric

1. Aeroflex / Aerocel EPDM
2. Armacell / Armaflex
3. RBX Industries / Rubatex

2.2 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Calcium Silicate:

1. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
2. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.

3. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

G. 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. Block Insulation: ASTM C 552, Type I.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

H. Fiberglass

1. Flexible glass fiber; ASTM C553 and ASTM C1290; commercial grade; 'k' value of 0.25 at 75 degrees F; 1.5 lb/cu ft minimum density; 0.002 inch foil scrim kraft facing for air ducts.
2. Rigid glass fiber; ASTM C612, Class 1; 'k' value of 0.23 at 75 degrees F; 3.0 lb/cu ft minimum density.
3. Duct liner, flexible glass fiber; ASTM C1071; Type II, 'k' value of 0.23 at 75 degrees F; 3.0 lb/cu ft minimum density; coating air side to be black, unless otherwise indicated, and rated for 4,000 feet per minute air velocity. The airstream surface must be protected with a durable polyacrylate copolymer emulsion, or approved equal, specifically formulated to:

   a. Not support the growth of fungus or bacteria, when tested in accordance with the test method for fungi resistance in ASTM D 5590 with "0" growth rating.
   b. Act as a fungicidal protective coating: water based, VOC < 50 g/l. Fungicidal coating must be EPA registered for use in HVAC duct systems.

2.3 ADHESIVES

A. Products: Subject to compliance with requirements, insulation manufacturer shall provide insulation adhesive and jacket manufacturer shall provide jacket adhesive.

B. 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.

C. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.

D. Cellular-Glass Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

A. Products: Subject to compliance with requirements, insulation manufacturer shall provide mastics.

B. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

C. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
4. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 200 deg F.
3. Solids Content: 63 percent by volume and 73 percent by weight.

E. Color: White.

2.5 SEALANTS

A. Products: Subject to compliance with requirements, insulation manufacturer shall provide sealants

B. Joint Sealants for Cellular-Glass Products:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

C. 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.

D. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jackets

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

    b. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
    c. for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
    d. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

6. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 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..

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. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.8 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, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; Metal Jacketing Systems.
    b. PABCO Metals Corporation; Surefit.
    c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

a. Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

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

1. Avery Dennison Corporation, Specialty Tapes Division.
2. Compac Corp.
3. Ideal Tape Co., Inc., an American Biltrite Company.
4. Venture Tape.
5. Dow Chemical Company (The).

B. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

C. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.

2.11 PIPE INSULATION HANGER SHIELDS:

A. Provide shields for hangers on all insulated pipe.

B. Insulation and shields shall consist of a 180 degree galvanized sheet steel shield. Shield lengths and minimum sheet metal gauges shall be as directed below:

| PIPE SIZE | SHIELD LENGTH | MINIMUM GAUGE |
|---|---|---|
| 1/2" to 8" | 12" | 16 |
| 10" & Larger | 22" | 16 |

C. Shields shall be Model CS-CW, except for pipe roller applications and where pipe hanger spacing exceeds 10 feet, then provide Model CSX-CW.

D. At the Contractor's option, shop-fabricated galvanized metal shields may be provided based on approved shop drawings. Length and gauge of sheet metal shall be as specified above.

2.12 PREMANUFACTURED COVERS

A. Preformed manufactured PVC fitting covers with rigid one piece (half-shell) preformed rigid insulation.

PART 3 - EXECUTION

3.1 GENERAL

A. Materials shall be applied by a qualified insulation applicator/workman skilled in this trade. Insulation shall be installed in accordance with the manufacturers written instructions and in accordance with recognized industry standards. Mechanical fasteners shall be used whenever possible to assure permanent construction. Unsightly work shall be cause for rejection.

B. Materials shall be applied only after surfaces have been tested and thoroughly cleaned of all mill scale, grease and dirt.

C. Non-compressible insulation material shall be installed at hanger supports on cold piping to prevent damage to insulation and vapor barrier. All wet pipe insulation shall be replaced.

D. Insulation of cold surfaces shall be vapor-sealed to prevent condensation.

E. Minimum thickness of insulation shall be as scheduled.

F. Install Pipe Insulation Hanger Shields.

G. Where piping system insulation is specified, cover valves, strainers, unions, flanges, and fittings. Refer to Preformed fitting and valve covers.

H. Extend piping insulation without interruption through walls, floors and similar piping penetrations, there shall be no exceptions.

3.2 APPLICATION TYPES

A. Equipment

E1: Cut insulation to fit contour of equipment, and secure by means of bands or adhesives as required for each individual piece of equipment. Provide vapor barrier and finish as required for each specific application. Provide new cold surfaces of pumps with accessible boxes that easily separate coincidental with parting line of evaporator heads and pump casings. Resulting insulation joints shall be covered with a self-sealing, vapor-barrier tape. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic.

B. Piping

P1: Butt insulation together and securely tape. Install factory-furnished laps at the butt joints. Neatly bevel and finish insulation where it terminates. Use of double tape self-sealing adhesives systems will negate requirements for staples.

P2: Butt insulation together and securely tape. Install factory-furnished laps at the butt joints. Neatly bevel and finish insulation where it terminates. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic.

P3: Same as P2, except install insulation over heat trace tape. Finish with metal jacket.

3.3 INSULATION SCHEDULE KEYS

**Insulation Types Key**

| | Type | Maximum K Factor @ 75°F | Temp. Limit °F | Density Lb. Per Cubic Foot | Federal Spec. Compliance |
|---|---|---|---|---|---|
| 1. | Calcium Silicate | 0.38 | 1200 | 14 | HH-I-523C |
| 2. | Fiberglass (Rigid) | 0.23 | 450 | 3 | ASTM C 547 Type 1 |
| 3. | Foamed Glass (Cellular) | 0.36 | 850 | 9 | HH-I-1751/3A |
| 4. | Foamed Plastic (Flexible) | 0.25 | 220 | 5 | HH-I-573 |
| 5. | Insulating Cement | 0.7 | 1700 | | SS-C-160 |

| Finishes Key | |
|---|---|
| F1. | 8-ounce glass cloth |
| F2. | Insulation cement |
| F3. | 0.016 aluminum, plain, up through 12" pipe size; 0.016 aluminum, corrugated, for pipe sizes 14" and larger |
| F4. | White all-service jacket (vapor barrier) with self-sealing lap, or taped joints |
| F5. | Two coats vinyl lacquer type white paint |

3.4 EQUIPMENT AND PIPING INSULATION SCHEDULES

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 unless there is a potential for personnel injury.

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings.

C. Fitting and Valve Covers:

1. Fitting covers shall be of preformed PVC for indoor service and metal for outdoor service.
2. Insulation material shall be rigid and of the same or greater material type and thickness, density and conductivity as the adjoining pipe. Blanket inserts will not be allowed.
3. Field fabricated fitting covers of same or similar material as pipe covering with preformed rigid inserts as specified in paragraph 1 above

D. Exposed piping for ADA compliant lavatories shall be provided with premanufactured covers complying with ASTM E-84 for P-traps, waste piping and angle stop valves.

## EQUIPMENT AND PIPING INSULATION SCHEDULE

| | INSULATION TYPE | THICKNESS | APPLICATION TYPE | INSULATION FINISH | | |
|---|---|---|---|---|---|---|
| | | | | INDOOR CONCEALED | INDOOR EXPOSED | OUTDOOR |
| Domestic cold water; bottom of roof drains and overflow drains; horizontal storm drains and overflow drains within building; waste piping conveying cooling coil condensate; waste from chilled drinking water fountains. | | | | | | |
| Indoor: | 2 | 1" | P2 | F4 | F4 | -- |
| Outdoor: | 2 | 1" | P2 or P3 | | -- | F4 & F3 |
| Domestic hot water supply & recirculation. | | | | | | |
| Indoor: | 2 | Note 1 | P1 | F4 | F4 | -- |
| Domestic water pumps. | | | | | | |
| Indoor: | 2, 3, or 4 | 2" | E1 | -- | F1, F2, F3, or F5 | F3 or F5 |
| Domestic water storage tank | | | | | | |
| Indoor: | 2 | 1 1/2" | E1 | -- | F2 & F1 | F4 & F3 |
| Medical Vacuum pump exhaust piping | | | | | | |
| Indoor: | 1 | 2" | P1 | -- | F2 | -- |

* Provide insulation where piping is heat traced.
** Refer to insulation types and finishes keys.
*** Table does not apply to factory insulated equipment
Note 1 – See "Domestic Hot Water Pipe Insulation Thickness" table below.

### DOMESTIC HOT WATER PIPE INSULATION THICKNESS

| SUPPLY WATER TEMP °F | NON-CIRCULATING RUNOUTS UP TO 1" | CIRCULATING MAINS AND BRANCHES | | |
|---|---|---|---|---|
| | | UP TO 1 1/4" | 1 1/2" & 2" | OVER 2" |
| 170-180 | 1" | 1" | 1 1/2" | 2" |
| 140-160 | 1" | 1" | 1" | 1 1/2" |
| 100-130 | 1" | 1" | 1" | 1" |

**Note:**

1. The above table is only applicable to insulations in the conductivity range of 0.23 to 0.25. For insulation outside these conductivity ranges, the minimum thickness (T) shall be determined by the following calculation and the calculation submitted for approval:

$$T=r\{(1+t/r)^{K/k} - 1\}$$

where T = Thickness
$r$ = Actual outside radius of pipe (in.)
$t$ = Insulation thickness per the above table
K = Conductivity of alternate material
k = Upper value of the Conductivity Range per the above table

END OF SECTION 220700

# PART 1 - GENERAL

## 1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Encasement for piping.

B. Related Section:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and fittings.
2. Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.

## 1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

B. Provide components and installation capable of producing domestic water piping systems with 80 psig, unless otherwise indicated.

## 1.3 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Water Sample Reports: Specified in Part 3 "Cleaning" Article.

C. Field quality-control test reports.

## 1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 and NSF 372 for potable domestic water piping and components.

C. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings. Provide proof of training with Installer's Credential Card.

## 1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect, Construction Manager and Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

B. Copper or Bronze Pressure-Seal Fittings:

1. Manufacturers:

a. Elkhart Products (Apolloxpress).
b. NIBCO Inc. (Press System).
c. Viega (ProPress).

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.
6. Smart Connect feature to guarantee identification of unpressed connections during the testing process.

C. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.

1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.

2.3 STAINLESS STEEL PIPE AND FITTINGS

A. Stainless Steel Pipe: ASTM A312, Type 304/304L or 316/316L, Sch. 10S, pipe, dimensions conforming to ANSI/ASME B36.19M-1085.

1. Stainless Steel Pressure-Seal:

a. Manufacturers:

1) Victaulic Company of America (Vic-Press).
2) Viega.

b. Pipe: NPS 2 (DN50) and smaller.
c. Fittings: 304 / 316, ASTM A-312 stainless steel housings with ASTM A-276 and A-312 outlets and austenitic stainless steel plain or grooved ends, type 304, complete with synthetic rubber Grade "H" (HNBR) seals rated for applicable services to +210 Deg F; Grade "E" EPDM for applicable services to +250 Deg F. System shall be rated to 500 psi (3447 kPa) unless noted otherwise. NSF 61 rated for hot and cold water services, NSF 372 rated lead free.

2. Grooved Joint Stainless Steel Pipe Appurtenances:

a. Manufacturers:

1) Victaulic Company.
2) Anvil International.
3) Shurjoint Piping Products.

b. Pipe: Roll groove stainless steel pipe with grooving tools specifically designed for stainless steel pipe.
c. Grooved-End Couplings: Hot dip galvanized ductile iron conforming to ASTM A-536, grade 65-45-12 housing and synthetic EPDM gasket of central cavity pressure-response design; with nuts, bolts, locking pin, locking toggle or lugs to secure grooved pipe and fittings. NSF 61 rated for hot and cold water service, NSF 372 rated lead free.

1) Flange Adapters: For use with stainless steel grooved end pipe and fittings, for mating to ANSI Class 150 raised-face flanges.

## 2.4 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

## 2.5 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Form: Sheet or Tube.

C. Material: LLDPE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch minimum thickness.

D. Color: Black.

2.6 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.7 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. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers:

a. Cascade Waterworks Manufacturing.
b. Dresser, Inc.; Dresser Piping Specialties.
c. Ford Meter Box Company, Inc. (The).
d. JCM Industries.
e. Romac Industries, Inc.
f. Smith-Blair, Inc; a Sensus company.
g. Viking Johnson; c/o Mueller Co.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Manufacturers:

a. EPCO Sales, Inc.
b. Hart Industries International, Inc.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
d. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description:

a. Pressure Rating: 150 psig at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric-Flange Kits:

1. Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. 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.

D. Dielectric Couplings:

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corporation.

2. Description:

a. Galvanized-steel coupling.

b. Pressure Rating: 300 psig at 225 deg F.
c. End Connections: Female threaded.
d. Lining: Inert and noncorrosive, thermoplastic.

E. Dielectric Nipples:

1. Manufacturers:

a. Perfection Corporation; a subsidiary of American Meter Company.
b. Precision Plumbing Products, Inc.
c. Victaulic Company.

2. Description:

a. Copper-Silicon nipple complying with ASTM F 1545.
b. Pressure Rating: 300 psig at 225 deg F.
c. End Connections: Male threaded or grooved.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105.

E. Install shutoff valve, hose-end drain valve, strainer and pressure gage inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

F. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

G. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. 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.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping adjacent to equipment and specialties to allow service and maintenance.

L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

Q. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

R. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Pressure-Sealed Joints:

1. Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.
2. Sealing element shall be verified for the intended use.
3. Tube ends shall be cut on a right angle (square) to the tube.
4. Tube ends shall be reamed and chamfered, all grease, oil or dirt shall be removed from the tube end with a clean rag.
5. Visually examine the fitting sealing element to ensure there is no damage, and it is properly seated into the fitting.
6. Utilizing an Insertion Depth Inspection Gauge mark the tube wall, with a felt tip pen, at the appropriate location, or insert the tube fully into the fitting and mark the tube wall at the face of the fitting.
7. Always examine the tube to ensure it is fully inserted into the fitting prior to pressing the joint.
8. Pressure-seal fittings ½-inch thru 4-inch shall be joined using appropriate sized tools.
9. Pressure-seal fittings shall be installed according to the most current edition of the Manufacturer's installation guidelines.

F. Grooved Joints: Pipe: Roll groove pipe with grooving tools specifically designed for pipe material. Assemble coupling with housing, gasket, lubricant, and bolts. Join pipe and grooved-end fittings according to AWWA C606 for roll-grooved joints.

1. All grooved components (including couplings, fittings, valves and accessories) to be supplied by one manufacturer. Grooving tools shall be of the same manufacturer as the groove components.
2. Grooving tools shall be equipped with roll sets specifically designed for pipe material. (Flaring of tube or fitting ends to accommodate IPS sized couplings is not permitted.)
3. A factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. Factory representative shall periodically visit the job site and review installation. Contractor shall remove and replace any improperly installed products.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems and provide Dielectric isolator.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use butterfly valves for piping NPS 2-1/2 and larger.

C. Install hose end drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

D. Install automatic balancing valves in each hot-water circulation return branch. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for automatic balancing valves.

E. Install automatic balancing valves with a strainer upstream and a check valve immediately downstream.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 2 and Larger: Sleeve-type coupling.

3.6 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, nipples or unions.

C. Dielectric Fittings for NPS 2-1/2: Use dielectric flange kits.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Perform the following tests on pressure-seal piping:

1. After fittings have been installed a "two step test" shall be followed.

    a. Pressurize the system with application appropriate test medium, water between 15 and 85 psi, or air/dry nitrogen between .5 and 45 psi.
    b. Check the pressure gauge for pressure loss.
    c. If the system does not hold pressure, walk the system and check for un-pressed fittings.
    d. Should an un-pressed fitting/s be identified, ensure the tube is fully inserted into the fitting, and properly marked, prior to pressing the joint.
    e. After appropriate repairs have been made, retest the system per local code, or specification requirements, not to exceed 600 psi with water.

E. Domestic water piping will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.11 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. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.12 CLEANING

A. Clean and disinfect potable and 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 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. Submit water samples for testing in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

3.13 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building-service entrance piping, NPS 8 and smaller, shall be the following:

1. Mechanical-joint, ductile-iron pipe; standard-pattern mechanical-joint fittings; and mechanical joints.

D. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type k; No joints below grade.

E. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L ASTM B 88; cast- or wrought- copper solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal fittings; and pressure-seal joints.
3. Stainless steel pipe, ASTM A312, schedule 10S; stainless steel pressure-seal fittings; and pressure-seal joints.

F. Aboveground domestic water piping, NPS 2 1/2 and larger, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L ASTM B 88; cast- or wrought- copper solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal fittings; and pressure-seal joints.
3. Hard copper tube, ASTM B 88, Type L; grooved-joint copper-tube appurtenances; and grooved joints.
4. Stainless steel pipe, ASTM A312, schedule 10S; grooved-joint stainless steel appurtenances; and grooved joints.
5. Stainless steel pipe, ASTM A312, schedule 10S; stainless steel pressure-seal fittings; and pressure-seal joints.

G. Non-Potable-Water Piping: Use same materials as domestic water piping

3.14 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 valves for piping NPS 2 and smaller. Use butterfly valves with flanged or grooved ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly valves with flanged or grooved ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Automatic 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.

END OF SECTION 221116

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Thermostatic mixing valves.
6. Strainers.
7. Wall boxes.
8. Hose bibbs.
9. Wall hydrants.
10. Drain valves.
11. Water hammer arresters.
12. Air vents.
13. Waterless trap seals.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 22 Section "Domestic Water Piping" for water meters.

## 1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

## 1.3 SUBMITTALS

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

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include operation, and maintenance manuals.

## 1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. NSF Compliance: NSF 61-G for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers:

a. Conbraco Industries, Inc.
b. FEBCO; SPX Valves & Controls.
c. Watts Industries, Inc.; Water Products Div.
d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers:

a. Conbraco Industries, Inc.
b. MIFAB, Inc.
c. Watts Industries, Inc.; Water Products Div.
d. Woodford Manufacturing Company.
e. Zurn Plumbing Products Group.

2. Standard: ASSE 1011.
3. Body: Brass, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or Rough bronze.

C. Pressure Vacuum Breakers:

1. Manufacturers:

a. Conbraco Industries, Inc.
b. FEBCO; SPX Valves & Controls.
c. Watts Industries, Inc.; Water Products Div.
d. Zurn Plumbing Products Group; Wilkins Div.
e. Beeco, LLC.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.

4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Accessories:

    a. Valves: Ball type, on inlet.

D. Laboratory-Faucet Vacuum Breakers:

1. Manufacturers:

    a. Conbraco Industries, Inc.
    b. Watts Industries, Inc.; Water Products Div.
    c. Woodford Manufacturing Company.
    d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1035.
3. Size: NPS 1/4 or NPS 3/8 matching faucet size.
4. Body: Bronze.
5. End Connections: Threaded.
6. Finish: Chrome plated.

E. Spill-Resistant Vacuum Breakers:

1. Manufacturers:

    a. Conbraco Industries, Inc.
    b. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.
4. Accessories:

    a. Valves: Ball type, on inlet.

2.2 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Manufacturers:

    a. Conbraco Industries, Inc.
    b. FEBCO; SPX Valves & Controls.
    c. Honeywell Water Controls.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Body: Bronze.
5. End Connections: Union or solder joint.
6. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers:

    a. Conbraco Industries, Inc.
    b. FEBCO; SPX Valves & Controls.
    c. Watts Industries, Inc.; Water Products Div.
    d. Zurn Plumbing Products Group; Wilkins Div.
    e. Beeco, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved or steel with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Pressure Regulators:

1. Manufacturers:

    a. Conbraco Industries, Inc.
    b. Honeywell Water Controls.
    c. Watts Industries, Inc.; Water Products Div.
    d. Zurn Plumbing Products Group; Wilkins Div.
    e. Beeco, LLC.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Provide integral bypass on PRV serving booster heaters.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water Control Valves:

1. Manufacturers:

    a. CLA-VAL Automatic Control Valves.
    b. OCV Control Valves.
    c. Watts Industries, Inc.; Watts ACV.
    d. Zurn Plumbing Products Group; Wilkins Div.
    e. Beeco, LLC.

2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve.

3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.

    a. Pattern: Angle or Globe-valve design.
    b. Trim: Stainless steel.

5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.4 BALANCING VALVES

A. Maunal Balancing Valves:

1. Manufacturers:

    a. Bell & Gossett
    b. Armstrong International
    c. NIBCO
    d. Watts

2. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
3. Body: Bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.5 THERMOSTATIC MIXING VALVES

A. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Leonard Valve Company.
    b. Powers.
    c. Watts; a Watts Water Technologies company.
    d. Zurn Industries, LLC.

2. Standard: ASSE 1016 and 1070, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating for NPS 2-1/2 and larger.

3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:

    a. Strainers NPS 2 and Smaller: 0.020 inch.
    b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
    c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.7 WALL BOXES

A. Outlet Boxes:

1. Manufacturers:

    a. Acorn Engineering Company.
    b. Guy Gray Manufacturing Co., Inc.
    c. IPS Corporation. (Guy Gray)
    d. Oatey.
    e. Symmons Industries, Inc.
    f. Watts Industries, Inc.; Water Products Div.
    g. Whitehall Manufacturing; a div. of Acorn Engineering Company.
    h. Zurn Plumbing Products Group.

2. Mounting: Recessed.
3. Material and Finish: Stainless-steel box and faceplate.
4. Faucet: Combination, valved fitting or separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Supply Shutoff Fittings: NPS 1/2 ball valves and NPS 1/2 copper, water tubing.
6. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.

B. Supply Boxes:

1. Manufacturers:

    a. Acorn Engineering Company.
    b. IPS Corporation. (Guy Gray)
    c. Oatey.

2. Mounting: Recessed.
3. Material and Finish: Stainless-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 ball valve and NPS 1/2 copper, water tubing.

2.8 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.

4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Refer to Plumbing Fixture Schedule on drawings for finishes.

2.9 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers:

a. Josam Company.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Woodford Manufacturing Company.
g. Zurn Plumbing Products Group.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.

9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Operating Keys(s): One with each wall hydrant.
11. Refer to Plumbing Fixture Schedule on drawings for finishes.

2.10 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. Body: Copper alloy.
4. Ball: Chrome-plated brass.
5. Seats and Seals: Replaceable.
6. Handle: Vinyl-covered steel.
7. Inlet: Threaded or solder joint.
8. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.11 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers:

a. Josam Company.
b. MIFAB, Inc.
c. PPP Inc.
d. Sioux Chief Manufacturing Company, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.
g. Zurn Plumbing Products Group.

2. Standard: ASSE 1010.
3. Type: Copper tube with piston.
4. Size: Sizes AA and A.

2.12 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Inlet and Vent Outlet End Connections: Threaded.

2.13 WATERLESS TRAP SEALS

A. Waterless trap Seals:

1. Manufacturers:

a. MIFAB, Inc.
b. PPP Inc.
c. Sioux Chief Manufacturing Company, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1072.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
2. Do not install bypass piping around backflow preventers.

C. Install water pressure regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

D. Install water control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

E. Install balancing valves in locations where they can easily be adjusted.

F. Install thermostatic mixing valves with check stops or shutoff valves and strainers on inlets and with shutoff valve on outlet.

1. Install thermometers on inlets and outlet and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

G. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

H. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

I. Install water hammer arresters in water piping according to PDI-WH 201 and drawings.

J. Install air vents at high points of water piping. Install drain piping and discharge to floor drain.

K. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

L. Install electric trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

## 3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Double-check backflow-prevention assemblies.
5. Pressure-reducing valves.
6. Manual balancing valves.
7. Thermostatic mixing valves.
8. Wall boxes.
9. Waterless trap seals.

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 Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer, double-check backflow-prevention assembly and vacuum breaker assembly according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Confirm flow rate and direction of flow for automatic balancing valves.

C. Set field-adjustable temperature set points of thermostatic mixing valves.

END OF SECTION 221119

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.

B. Related Sections include the following:

1. Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

## 1.2 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. LLDPE: Linear, low-density polyethylene plastic.

C. NBR: Acrylonitrile-butadiene rubber.

D. PE: Polyethylene plastic.

E. PVC: Polyvinyl chloride plastic.

F. TPE: Thermoplastic elastomer.

## 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.
2. Sanitary Sewer, Force-Main Piping: 50 psig.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

## 1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.

C. Field quality-control inspection and test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall be American manufactured and bear label, stamp, or other markings of specified testing agency.

B. All cast iron Piping and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed with NSF international.

C. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: Assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, ASTM C 1540 and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) Clamp-All Corp.-125
2) Husky SD 4000

2.2 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

2.3 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.4 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Dallas Specialty & Mfg. Co.

b. Fernco, Inc.
c. Logan Clay Products Company (The).
d. Mission Rubber Co.
e. NDS, Inc.

2. Sleeve Materials:

a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: 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.

1. Manufacturers:

a. Husky
b. Cascade Waterworks Mfg. Co.
c. Mission Rubber Co.

2.5 DRIP PANS

A. Of not less than 14-gauge galvanized steel with raised sides and galvanized steel pipe nipple drains welded in place at low points.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. PVC piping shall not be used within occupied spaces or plenums of occupied spaces.

C. Aboveground, soil and waste piping shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.

D. Aboveground, vent piping shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.

E. Underground, soil, waste, and vent piping shall be any of the following:

1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.2 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

F. Install underground, steel, force-main piping.

G. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside the building between wall and floor penetrations and connection to sanitary sewer piping outside the building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

H. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

I. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

J. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

L. 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 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

M. 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.

N. Install soil and waste drainage and vent piping downward in direction of flow at the slopes required by local code or Authorities Having Jurisdiction, unless otherwise indicated on drawings.

O. 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. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

P. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

Q. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Hubless cast-iron piping 6" and larger shall be restrained at any direction change using blocks, rods, bracing or other suitable methods.

T. Provide drip pans under waste lines concealed above operating, cysto and delivery rooms, cath labs, nurseries, food preparation centers, food serving facilities, food storage areas, central services, electronic data processing areas, electric and telecommunication closets, and other sensitive areas, or as shown on the plans. Pans shall be of galvanized steel, arranged to drain outside these areas, or as noted on Drawings.

U. In central plants, central sterile and kitchens where waste above 140°F is frequently discharged into the sanitary system use cast iron piping for the first 40 feet, before transitioning to any other piping material.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

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.

C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Support vertical piping and tubing at base and at each floor.

E. Install supports for vertical cast-iron soil piping every 15 feet.

F. Install supports for vertical steel piping every 15 feet.

G. Install supports for vertical stainless-steel piping every 10 feet.

H. Install supports for vertical copper tubing every 10 feet.

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 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. 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. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main or sanitary manhole.
2. Sewage Pumps: To sewage pump discharge.

3.6 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.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. 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 to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

## 3.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.8 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 221316

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Through-penetration firestop assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.

B. Related Sections include the following:

1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
2. Division 22 Section "Plumbing Fixtures" for hair interceptors.
3. Division 22 Section "Healthcare Plumbing Fixtures" for plaster sink interceptors.
4. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

## 1.2 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

## 1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1. Grease interceptors.
2. Oil interceptors.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

C. Manufacturer Seismic Qualification Certification: Submit certification that grease interceptors, oil interceptors, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Refer to Architect for seismic criteria.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

## 1.4 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.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, refer to table for area and provide the product indicated or a comparable product by one of the following:

   1) Linoleum Floors: J.R. Smith Series 4140 - round top with insert
   2) Carpeted Floors: J.R. Smith Series 4240-Y - round with carpet marker
   3) Exterior: J. R. Smith 4240 - round with cast iron cover
   4) Wall: J.R. Smith Series 4710
   5) Quarry Floor: J.R. Smith Series 4053-PB - square bronze top
   6) Ceramic Floor: J.R. Smith Series 4053-NB - square nickel bronze top
   7) Concrete Floors: J. R. Smith Series 4100 - round nickel bronze top.
   8) Truck/Loading Dock Areas: J. R. Smith Series 4231 - ductile iron top.

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Body Material: cast-iron as required to match connected piping.
4. Closure: Countersunk or raised-head, brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

2.2 FLOOR DRAINS AND FLOOR SINKS

A. Floor Drains and Floor Sinks:

1. Manufacturers:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Light Commercial Operation.
g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.
3. Refer to schedule on drawings

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company; Elmdor/Stoneman Div.
b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Hub Drain:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: as indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. 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.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install floor drains/sinks at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains/sinks for easy access and maintenance.
2. Set floor drains/sinks 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/sink 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/sinks connected to sanitary building drain, unless otherwise indicated.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

G. Assemble open drain fittings and install with top of hub 1 inch above floor.

H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

I. Install floor-drain/sink, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

L. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

M. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

N. Install wood-blocking reinforcement for wall-mounting-type specialties.

O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

D. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.

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.
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.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal 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 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories showers and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. P-traps, Supplies and strainers.
6. Fixture supports.
7. Water closets.
8. Lavatories.
9. Sinks.
10. Showers.
11. Service sinks.
12. Service basins.

B. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
3. Division 22 Section "Healthcare Plumbing Fixtures."
4. Division 22 Section "Emergency Plumbing Fixtures."
5. Division 22 Section "Drinking Fountains and Water Coolers."
6. Division 31 Section "Facility Water Distribution Piping" for exterior plumbing fixtures and hydrants.

## 1.2 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

F. FRP: Fiberglass-reinforced plastic.

G. PMMA: Polymethyl methacrylate (acrylic) plastic.

H. PVC: Polyvinyl chloride plastic.

I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act" ; and Public Law 101-336, "Americans with Disabilities Act" ; for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Plastic Bathtubs: ANSI Z124.1.
3. Plastic Lavatories: ANSI Z124.3.
4. Plastic Laundry Trays: ANSI Z124.6.
5. Plastic Mop-Service Basins: ANSI Z124.6.
6. Plastic Shower Enclosures: ANSI Z124.2.
7. Plastic Sinks: ANSI Z124.6.

8. Plastic Urinal Fixtures: ANSI Z124.9.
9. Plastic Whirlpool Bathtubs: ANSI Z124.1 and ASME A112.19.7M.
10. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
11. Slip-Resistant Bathing Surfaces: ASTM F 462.
12. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
13. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
14. Stainless-Steel Residential Sinks: ASME A112.19.3.
15. Vitreous-China Fixtures: ASME A112.19.2M.
16. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
17. Water-Closet, Flushometer Tank Trim: ASSE 1037.
18. Whirlpool Bathtub Fittings: ASME A112.19.8M.

H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for bath-tub/shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
4. Faucets: ASME A112.18.1.
5. Hand-Held Showers: ASSE 1014.
6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Manual-Control Antiscald Faucets: ASTM F 444.
9. Pipe Threads: ASME B1.20.1.
10. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
12. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Dishwasher Air-Gap Fittings: ASSE 1021.
4. Manual-Operation Flushometers: ASSE 1037.
5. Plastic Tubular Fittings: ASTM F 409.
6. Brass Waste Fittings: ASME A112.18.2.

7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Dishwasher Air-Gap Fittings: ASSE 1021.
3. Flexible Water Connectors: ASME A112.18.6.
4. Floor Drains: ASME A112.6.3.
5. Grab Bars: ASTM F 446.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Hot-Water Dispensers: ASSE 1023 and UL 499.
8. Off-Floor Fixture Supports: ASME A112.6.1M.
9. Pipe Threads: ASME B1.20.1.
10. Plastic Shower Receptors: ANSI Z124.2.
11. Plastic Toilet Seats: ANSI Z124.5.
12. Supply and Drain Protective Shielding Guards: ICC A117.1.
13. Whirlpool Bathtub Equipment: UL 1795.

## 1.5 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures of unit shell.
   b. Faulty operation of controls, blowers, pumps, heaters, and timers.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period for Commercial Applications: One year(s) from date of Substantial Completion.

## 1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.
4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
5. Water-Closet Tank, Repair Kits: Equal to 5 percent of amount of each type installed.
6. Toilet Seats: Equal to 5 percent of amount of each type installed.
7. Dry Urinal Trap-Seal Cartridges: 10 of each type installed.
8. Dry Urinal Trap-Seal Liquid: Equal to 1 gal for each urinal installed.

PART 2 - PRODUCTS

2.1 LAVATORY AND SINK FAUCETS

A. Lavatory and Sink Faucets:

1. Manufacturers:

a. American Standard Companies, Inc.
b. Chicago Faucets.
c. Delta Faucet Company.
d. Eljer.
e. Elkay Manufacturing Co.
f. Just Manufacturing Company.
g. Kohler Co.
h. Moen, Inc.
i. Speakman Company.
j. T & S Brass and Bronze Works, Inc.
k. Zurn Plumbing Products Group.

2.2 FLUSHOMETERS

A. Flushometers:

1. Manufacturers:

a. Coyne & Delany Co.
b. Sloan Valve Company.
c. Zurn Plumbing Products Group.

2.3 TOILET SEATS

A. Toilet Seats:

1. Manufacturers:

a. American Standard Companies, Inc.
b. Bemis Manufacturing Company.
c. Centoco Manufacturing Corp.
d. Church Seats.
e. Eljer.
f. Kohler Co.
g. Olsonite Corp.
h. Sperzel.

2.4 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers:

a. Engineered Brass Co.
b. McGuire Manufacturing Co., Inc.

c. TRUEBRO, Inc.
d. Zurn Plumbing Products Group.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements and ASTM E-84.

2.5 P-TRAPS, SUPPLIES, STRAINERS

A. Manufacturers:

1. McGuire Manufacturing Co., Inc.
2. Elkay Manufacturing Co.
3. American Standard Companies, Inc.
4. Kohler Co.
5. Engineered Brass Co.
6. Zurn Plumbing Products Group.

2.6 FIXTURE SUPPORTS

A. Manufacturers:

1. Josam Company.
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group.

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2.7 LAVATORIES

A. Lavatories:

1. Manufacturers:

a. American Standard Companies, Inc.
b. Eljer.
c. Kohler Co.
d. Zurn Plumbing Products Group.

2.8 SINKS

A. Sinks:

1. Manufacturers:

a. Elkay Manufacturing Co.
b. Just Manufacturing Company.
c. Metal Masters Foodservice Equipment Co., Inc.

2.9 SHOWERS

A. Showers:

1. Manufacturers:

a. Aqua Glass Corporation.
b. Florestone Products Co., Inc.
c. LASCO Bathware.
d. Swan Corporation (The).
e. Aqua Bath Company, Inc.
f. Kohler Co.

2.10 SERVICE SINKS

A. Service Sinks:

1. Manufacturers:

a. American Standard Companies, Inc.
b. Eljer.
c. Kohler Co.
d. Zurn Plumbing Products Group.

2.11 SERVICE BASINS

A. Service Basins:

1. Manufacturers:

a. Acorn Engineering Company.
b. Florestone Products Co., Inc.
c. Stern-Williams Co., Inc.

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 plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to roughing-in drawings.

I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

M. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

N. Install toilet seats on water closets.

O. Install trap-seal liquid in dry urinals.

P. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

R. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

S. Install shower flow-control fittings with specified maximum flow rates in shower arms.

T. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

U. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

V. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

W. Set shower receptors in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

X. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

D. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

# PART 1 - GENERAL

## 1.1 SUMMARY

A.

B. This Section includes the following medical plumbing fixtures and related components:

1. Bedpan washers.
2. Patient Care Module.
3. Clinical sinks.
4. Plaster sinks.
5. Surgeons' scrub sinks.
6. Sitz baths.
7. Dialysis boxes.

C. Related Sections include the following:

1. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.
2. Division 22 Section "Sanitary Waste Piping Specialties" for floor drains.
3. Division 22 Section "Plumbing Fixtures" for conventional plumbing fixtures.
4. Division 22 Section "Emergency Plumbing Fixtures."
5. Division 22 Section "Drinking Fountains and Water Coolers."

## 1.2 DEFINITIONS

A. Accessible Medical Plumbing Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls the flow of water into or out of the medical plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads, drains and tailpieces, and traps and waste pipes.

C. FRP: Fiberglass-reinforced plastic.

D. PMMA: Polymethyl methacrylate (acrylic) plastic.

## 1.3 SUBMITTALS

A. Product Data: For each type of medical plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For medical plumbing fixtures to include in emergency, operation, and maintenance manuals.

## 1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain medical plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act" ; and Public Law 101-336, "Americans with Disabilities Act" ; for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for medical plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Slip-Resistant Bathing Surfaces: ASTM F 462.
3. Vitreous-China Fixtures: ASME A112.19.2M.

H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Flexible Water Connectors: ASME A112.18.6.
4. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Grab Bars: ASTM F 446.
2. Hose-Coupling Threads: ASME B1.20.7.
3. Off-Floor Fixture Supports: ASME A112.6.1M.
4. Pipe Threads: ASME B1.20.1.
5. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 EXTRA MATERIALS

A. Refer to Section 224000 "Plumbing Fixtures"

PART 2 - PRODUCTS

2.1 BEDPAN WASHERS

A. Bedpan Washers:

1. Manufacturers:

a. Acorn Engineering Company.
b. Chicago Faucets.
c. T & S Brass and Bronze Works, Inc.

2. Description: Wall-mounting, hand-held, hand-control medical plumbing fixture.

a. Hose: 48-inch-long rubber or vinyl hose with spray nozzle, wall bracket, and hook.
b. Self-closing valve.
c. Loose-key supply stop.
d. Vacuum Breaker: Wall mounting, atmospheric.
e. Finish: Polished, chrome-plated finish on metal parts exposed after installation.

2.2 CLINICAL SINKS

A. Wall-Mounting Clinical Sinks:

1. Manufacturers:

a. American Standard Companies, Inc.
b. Crane Plumbing, L.L.C./Fiat Products.
c. Eljer.
d. Kohler Co.

B. Floor mounted Clinical Sinks:

1. Manufacturers:

a. American Standard Companies, Inc.
b. Crane Plumbing, L.L.C./Fiat Products.
c. Eljer.
d. Kohler Co.
e. Zurn

2.3 SURGEONS' SCRUB SINKS

a. Owner furnished equipment

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for medical plumbing fixtures to verify actual locations of piping connections before fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Assemble medical plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to domestic water piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball valve if stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.

K. Install escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

L. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from domestic water piping to medical plumbing fixtures.

C. Connect drain piping from medical plumbing fixtures to sanitary waste and vent piping.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed medical plumbing fixtures are categories and types specified for locations where installed.

B. Check that medical plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed medical plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning medical plumbing fixtures, fittings, and controls.

B. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean medical plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of medical plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Retain selection below for HCA projects.

B. This Section includes the following emergency plumbing fixtures:

1. Eyewash equipment.

C. Related Sections include the following:

1. Division 22 Section "Sanitary Waste Piping Specialties" for floor drains.

1.2 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Tepid: Moderately warm.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For emergency plumbing fixtures to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act" ; and Public Law 101-336, "Americans with Disabilities Act" ; for plumbing fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers for Emergency Showers, Eyewash Equipment, Eye/Face-wash Equipment, Hand held Drench Hoses and Combination Units:

1. Bradley Corporation.
2. Guardian Equipment Co.
3. Haws Corporation.
4. Lab Safety Supply Inc.
5. Speakman Company.

2.2 EYEWASH EQUIPMENT

A. Eyewash Equipment, EEW-1:

1. Description: Plumbed, deck-mounted eyewash equipment.

a. Capacity: Deliver potable water at rate not less than 0.4 gpm.
b. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
c. Control-Valve Actuator: Paddle.
d. Drain Piping: NPS 1-1/4 minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2.

2.3 WATER-TEMPERING EQUIPMENT

A. Water-Tempering Equipment,

1. Manufacturers:

a. Armstrong International, Inc.
b. Bradley Corporation.
c. Haws Corporation.
d. Lawler Manufacturing Co., Inc.
e. Leonard Valve Company.
f. Powers, a Watts Industries Co.

2. Description: Factory-fabricated, hot- and cold-water-tempering equipment with thermostatic mixing valve.

a. Thermostatic Mixing Valve: Designed to provide 90 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 2 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.

## 2.4 SOURCE QUALITY CONTROL

A. Certify performance of plumbed emergency plumbing fixtures by independent testing agency acceptable to authorities having jurisdiction.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

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

## 3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Install shutoff valves in water-supply piping to fixtures. Use ball valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

1. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

D. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 22 Section "Common Work Results for Plumbing."

E. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 22 Section "Meters and Gages for Plumbing Piping."

F. Install trap and waste to wall on drain outlet of fixture receptors that are indicated to be directly connected to drainage system.

G. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system. Drainage piping is specified in Division 22 Section "Sanitary Waste and Vent Piping."

H. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

I. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment.

C. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.

D. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.

E. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary drainage piping.

3.4 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures.

B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

C. Report test results in writing.

3.5 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Nitrous oxide piping and specialties designated "medical nitrous oxide" operating at 50 to 55 psig.
2. Oxygen piping and specialties designated "medical oxygen" operating at 50 to 55 psig.

B. Owner-Furnished Material:

1. Med Gas booms.
2. Modular Headwalls.

3. Owner will furnish gases for medical gas concentration testing specified in this Section.

C. Related Sections include the following:

1. Division 12 Section "Healthcare Casework" for gas outlets in metal medical casework.
2. Division 22 Section "Compressed-Air Piping for Healthcare Facilities" for compressed-air piping systems for healthcare facilities.
3. Division 22 Section "Vacuum Piping for Healthcare Facilities" for vacuum piping systems for healthcare facilities.
4. Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for hangers and supports.
5. Division 22 Section "Common Work Results for Plumbing" for Sleeves and Escutcheons.

## 1.2 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. D.I.S.S.: Diameter-index safety system.

C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

D. Medical gas piping systems include medical nitrous oxide and medical oxygen nonflammable gas for healthcare facility patient care or for healthcare laboratory applications.

## 1.3 SUBMITTALS

A. Product Data: For the following:

1. Tubes and fittings.
2. Valves and valve boxes.
3. Medical gas outlets.
4. Ceiling hose assemblies. Include integral service connections.
5. Medical gas alarm system components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Piping Material Certification: Signed by Installer certifying that medical gas piping materials comply with NFPA 99 requirements.

D. Qualification Data: For Installer and testing agency.

E. Brazing certificates.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For medical gas piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Medical Gas Piping Systems for Healthcare Facilities: Qualify installers according to ASSE Standard #6010 for installers.

B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the medical gas piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Qualify testing personnel according to ASSE Standard #6020 for inspectors and ASSE Standard #6030 for verifiers.

2. The owner shall be notified a minimum of 24 hours in advance and witness all testing of medical gas piping.

C. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. ASME Compliance: Fabricate and label bulk medical gas storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

F. NFPA Compliance:

1. Comply with NFPA 99, for bulk oxygen storage tanks.
2. Comply with NFPA 99, "Health Care Facilities," for medical gas piping system materials and installation.

G. CGA Compliance: Comply with CGA G-8.1, "Nitrous Oxide Systems at Consumer Sites," for bulk nitrous oxide storage tanks.

H. UL Compliance:

1. Comply with UL 498, "Attachment Plugs and Receptacles," for electrical service connections.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Medical Gas Service(s): Do not interrupt medical gas 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, Construction Manager and Owner no fewer than five days in advance of proposed interruption of medical gas service(s).
2. Do not proceed with interruption of medical gas service(s) without Owner's written permission.

1.6 COORDINATION

A. Coordinate medical gas outlets with other service connections. Compressed-air service connections are specified in Division 22 Sections "Compressed-Air Piping for Healthcare Facilities" and "Vacuum Piping for Healthcare Facilities."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Copper Medical Gas Tube: ASTM B 819, Types K and L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and blue for Type L tube.

1. General Requirements for Copper Fittings: Manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.

2.2 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.

2.3 Manufacturers for all products listed below including valves, zone valve boxes, alarms and manifolds:

a. Allied Healthcare Products, Inc.
b. Amico Corporation.
c. BeaconMedaes.

2.4 VALVES

A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.

B. Ball Valves: MSS SP-110, 3-piece body, brass or bronze.

1. Pressure Rating: 300 psig minimum.
2. Ball: Full-port, chrome-plated brass.

3. Seats: PTFE or TFE.
4. Handle: Lever type with locking device.
5. Stem: Blowout proof with PTFE or TFE seal.
6. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

C. Check Valves: In-line pattern, bronze.

1. Pressure Rating: 300 psig minimum.
2. Operation: Spring loaded.
3. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

D. Zone Valves: MSS SP-110, 3-piece-body, brass or bronze ball valve with gage.

1. Pressure Rating: 300 psig minimum.
2. Ball: Full-port, chrome-plated brass.
3. Seats: PTFE or TFE.
4. Handle: Lever.
5. Stem: Blowout proof with PTFE or TFE seal.
6. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
7. Pressure Gage: Manufacturer-installed on one copper-tube extension.

E. Zone Valve Boxes: Formed steel with anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves.

1. Interior Finish: Factory-applied white enamel.
2. Cover Plate: Aluminum or extruded-anodized aluminum with frangible or removable windows.
3. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.

F. Emergency Oxygen Connections: Low-pressure oxygen inlet assembly for connection to building oxygen piping systems.

1. Enclosure: Weatherproof hinged locking cover with caption similar to "Emergency Low-Pressure Gaseous Oxygen Inlet."
2. Inlet: Manufacturer-installed, NPS 1, ASTM B 819, copper tubing with NPS 1 minimum ball valve and plugged inlet.
3. Safety Valve: Bronze-body, pressure relief valve set at 75 or 80 psig.
4. Instrumentation: Pressure gage.

G. Safety Valves: Bronze-body, ASME-construction, poppet, pressure-relief type with settings to match system requirements.

H. Pressure Regulators: Bronze body and trim; spring-loaded, diaphragm-operated, relieving type; manual pressure-setting adjustment; rated for 250-psig minimum inlet pressure; and capable of controlling delivered gas pressure within 0.5 psig for each 10-psig inlet pressure.

## 2.5 MEDICAL GAS OUTLETS

A. General Requirements for Medical Gas Outlets: For specific medical gas pressure and suction service listed. Include roughing-in assemblies, finishing assemblies, and cover plates. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate. Furnish recessed-type units made for concealed piping unless otherwise indicated.

1. Roughing-in Assembly:

   a. Steel outlet box for recessed mounting and concealed piping.
   b. Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed. Suction inlets to be without secondary valve.
   c. Double seals that will prevent gas leakage.
   d. ASTM B 819, NPS 3/8 copper outlet tube brazed to valve with service marking and tube-end dust cap.

2. Finishing Assembly:

   a. Brass housing with primary check valve.
   b. Double seals that will prevent gas leakage.
   c. Cover plate with gas-service label.

3. Quick-Coupler gas outlets: Pressure outlets for nitrous oxide and oxygen service connections with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.
4. D.I.S.S. gas outlets: Pressure outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.

   a. Medical Nitrous Oxide outlets: D.I.S.S. No. 1040.
   b. Medical Oxygen outlets: D.I.S.S. No. 1240.

2.6 CEILING HOSE ASSEMBLIES

A. Fixed Hose Service Assemblies: Individual, concealed hose connection with stainless-steel face plates, steel mounting boxes, factory- or field-fabricated mounting brackets, and color-coded service hoses with retractor device and service connections matching hoses. Include 72 inches of conductive, CR, 1/4- or 5/16-inch-, ID, medical gas hoses rated for 200-psig minimum working pressure, and the following service hose connections:

   1. Medical Air Hose: DISS inlet to quick-coupler outlet.
   2. Medical Nitrous Oxide Hose: DISS inlet to quick-coupler outlet.
   3. Medical Oxygen Hose: DISS inlet to quick-coupler outlet.
   4. Medical Vacuum Hose: DISS inlet to quick-coupler outlet.
   5. WAGD Evacuation Hose: DISS inlet to quick-coupler outlet.

2.7 MEDICAL GAS PIPING ALARM SYSTEMS

A. Panels for medical gas piping systems may be combined in single panels with medical compressed-air and medical vacuum piping systems.

B. Components: Designed for continuous service and to operate on power supplied from 120-V ac power source to alarm panels and with connections for low-voltage wiring to remote sensing devices. Include step-down transformers if required.

C. Pressure Switches or Pressure Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.

   1. Low-Pressure Operating Range: 0- to 100-psig.
   2. High-Pressure Operating Range: Up to 250-psig.

D. General Requirements for Medical Gas Alarm Panels: Factory wired with audible and color-coded visible signals to indicate specified functions.

1. Mounting: Recessed installation.
2. Enclosures: Fabricated from minimum 0.047-inch-thick steel or minimum 0.05-inch-thick aluminum, with knockouts for electrical and piping connections.

E. Area Alarm Panels: Separate trouble alarm signals; pressure gages; and indicators for medical gas piping systems.

1. Include alarm signals when the following conditions exist:

a. Medical Carbon Dioxide: Pressure drops below 40 psig or rises above 60 psig.
b. Medical Nitrous Oxide: Pressure drops below 40 psig or rises above 60 psig.
c. Medical Nitrogen: Pressure drops below 145 psig or rises above 200 psig.
d. Medical Oxygen: Pressure drops below 40 psig or rises above 60 psig.

2.8 NITROGEN

A. Description: Comply with USP 28 - NF 23 for oil-free dry nitrogen for blow down and testing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing are not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction, perform the following procedures:

1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1, "Cleaning Equipment for Oxygen Service."
2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb of chemical to 3 gal. of water.

a. Scrub to ensure complete cleaning.
b. Rinse with clean, hot water to remove cleaning solution.

3.2 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling and for underground warning tapes.

3.3 PIPING APPLICATIONS

A. Medical Gas Piping Except Nitrogen: Use Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.

B. Medical Nitrogen Piping NPS 2-1/2 and Smaller: Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.

C. Medical Nitrogen Piping NPS 3 and Larger: Type K, copper tube; wrought-copper fittings; and brazed joints.

3.4 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of gas piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, equipment sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Comply with ASSE Standard #6010 for installation of medical gas piping.

C. Install piping concealed from view and protected from physical contact by building occupants 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 and coordinate with other services occupying that space.

F. Install piping adjacent to equipment and specialties to allow service and maintenance.

G. Install nipples, and special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications below unless otherwise indicated.

H. Install piping to permit valve servicing.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install seismic restraints on gas piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

L. Install medical gas outlets recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.

M. Connect medical gas piping to medical gas sources and to medical gas outlets and equipment requiring medical gas service.

3.5 VALVE INSTALLATION

A. Install shutoff valve at each connection to healthcare equipment and specialties.

B. Install check valves to maintain correct direction of gas flow from healthcare gas supplies.

C. Install zone valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.

D. Install zone valves and gages in zone valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.

E. Install pressure regulators on gas piping where reduced pressure is required.

F. Install emergency oxygen connection with pressure relief valve and full-size discharge piping to outside, with check valve downstream from pressure relief valve and with ball valve and check valve in supply main from bulk oxygen storage tank.

3.6 JOINT CONSTRUCTION

A. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.

B. Threaded Joints: Apply appropriate tape to external pipe threads.

C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter. Continuously purge joint with oil-free, dry nitrogen during brazing.

D. Memory-Metal Coupling "Smart Tap" joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of memory-metal coupling joints.

3.7 GAS SERVICE COMPONENT INSTALLATION

A. Assemble patient headwall units with outlets. Install with supplies concealed, in walls. Attach console box or mounting bracket to substrate.

B. Install nitrogen pressure-control panels in walls. Attach to substrate.

C. Assemble ceiling assemblies and install anchored to substrate. Provide structural steel, hanger rods, anchors, and fasteners in addition to components furnished with specialties necessary to fabricate supports.

D. Install gas manifolds anchored to substrate.

E. Install gas cylinders and connect to manifold piping.

F. Install gas manifolds with seismic restraints as indicated.

3.8 MEDICAL GAS PIPING ALARM SYSTEM INSTALLATION

A. Install medical gas alarm system components in locations required by and according to NFPA 99.

B. Install medical gas area and master alarm panels where indicated.

3.9 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for healthcare medical gas piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:

1. Nitrous Oxide: White letters on blue background.
2. Oxygen: White letters on green background or green letters on white background.

3.10 FIELD QUALITY CONTROL FOR HEALTHCARE FACILITY MEDICAL GAS

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections of medical gas piping systems in healthcare facilities and prepare test reports.

B. Perform tests and inspections of medical gas piping systems in healthcare facilities and prepare test reports.

C. Tests and Inspections:

1. Medical Gas Piping Testing Coordination: Perform tests, inspections, verifications, and certification of medical gas piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical vacuum piping systems.

2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:

   a. Initial blow down.
   b. Initial pressure test.
   c. Cross-connection test.
   d. Piping purge test.
   e. Standing pressure test for positive pressure medical gas piping.
   f. Standing pressure test for vacuum systems.
   g. Repair leaks and retest until no leaks exist.

3. System Verification: Comply with requirements in NFPA 99, ASSE Standard #6020, and ASSE Standard #6030 for verification of medical gas piping systems and perform the following tests and inspections:

   a. Standing pressure test.
   b. Individual-pressurization or pressure-differential cross-connection test.
   c. Valve test.
   d. Master and area alarm tests.
   e. Piping purge test.
   f. Piping particulate test.
   g. Piping purity test.
   h. Final tie-in test.
   i. Operational pressure test.
   j. Medical gas concentration test.
   k. Medical air purity test.
   l. Verify correct labeling of equipment and components.
   m. Verify the following source equipment:

      1) Medical gas supply sources.

4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:

   a. Inspections performed.
   b. Procedures, materials, and gases used.
   c. Test methods used.
   d. Results of tests.

D. Remove and replace components that do not pass tests and inspections and retest as specified above.

3.11 DEMONSTRATION

A. Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain medical gas alarm system. Refer to Division 01 Section "Demonstration and Training."

B. The owner shall be notified a minimum of 24 hours in advance and witness all testing of medical gas piping.

END OF SECTION 226313

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Common terminology and requirements used throughout this Division.
2. Requirements for Acceptance Testing Agency.
3. Requirements for Professional Engineers responsible for Delegated Design.
4. Piping materials and installation instructions common to most piping systems.
5. Transition fittings.
6. Dielectric fittings.
7. Mechanical sleeve seals.
8. Sleeves.
9. Escutcheons.
10. Grout.
11. HVAC demolition.
12. Equipment installation requirements common to equipment sections.
13. Painting and finishing.
14. Concrete bases.
15. Supports and anchorages.

## 1.2 RELATED DOCUMENTS

A. In addition to Division 01 Specification Sections, related sections include the following:

1. Division 01 Section "Cutting and Patching"
2. Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
3. Division 03 Sections "Cast-in-Place Concrete" and "Miscellaneous Cast-in-Place Concrete".
4. Division 05 Section "Metal Fabrications" for structural steel.
5. Division 09 Sections "Interior Painting" and "Exterior Painting".
6. Division 08 Section "Access Doors and Frames" for access panels and doors.

## 1.3 DEFINITIONS

A. This section includes the following definitions that are common to most Division 23 Specifications.

1. Definitions found within this section, Division 23 "Common Work Results for HVAC," are considered to generally apply to all sections unless otherwise noted.
2. Other sections may increase or decrease the scope and usage of a particular word, phrase, or abbreviation for the section in which it appears.

B. AHJ: Authority Having Jurisdiction. This abbreviation is the general term for all agencies having oversight and/or inspection authority for a scope of work, trade, or system. AHJ includes agencies such as local and state fire marshals, city inspectors, et. al.

C. AHU: Air handling unit. This abbreviation is the general term for systems that filter and/or changes the sensible and/or latent properties of air supplied to a space. Its use is synonymous with RTU, roof top unit, irrespective of a system's physical location.

D. Bound Material: Bound refers to materials permanently bound, as by stitching or glue, or materials securely fastened in their covers by multiple fasteners that penetrate all papers. Ring binders, spiral binders, brads and screw posts are acceptable fasteners. Loose papers clipped together or stapled at one (1) corner are not acceptable.

E. Business Day: Where this Section and other Sections of this Division use the term "Business Day" it shall mean Monday thru Friday, excluding Holidays recognized by Federal, State and Local government.

F. CAV: Constant air volume.

G. 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.

H. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

I. CPVC: Chlorinated polyvinyl chloride plastic.

J. DDC: Direct-digital controls.

K. ECM: Electrically commutated motor.

L. EPDM: Ethylene propylene diene monomer rubber.

M. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

N. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

O. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

P. FMS: Facility Management System. May be used interchangeably with BAS, Building Automation System.

Q. Furnish: The material, equipment, etc. to be supplied, but not installed by the supplier.

R. Manufacturers:

1. Available Manufacturers: When used, this allows any manufacturer in compliance with the requirements to be submitted and used for the system indicated, pending engineer's approval. The list of manufacturers is intended to illustrate typical providers.
2. Basis-of-Design: The manufacturer indicated as such is required to be furnished. The Owner reserves the right to select additional manufacturers listed and adjust the bid amount up or down as is indicated on the bid form for the selected manufacturer.
3. Manufacturers: When used, restricts the list of acceptable manufacturers to only the entities indicated that comply with the requirements detailed.

a. Where the product of a single manufacturer is mentioned by trade name or manufacturer's name in this Division, it is the only acceptable manufacturer.
b. Where two (2) or more manufacturers are named, only those manufacturers will be considered or approved.

S. NBR: Acrylonitrile-butadiene rubber.

T. NRTL: Nationally Recognized Testing Laboratory.

U. PE: Polyethylene plastic.

V. Products and Materials: Components and assemblies for the construction of the systems as indicated in the Documents including, but not limited to pipes, tubes, ducts, and equipment.

W. Products or Materials: See "Products and Materials".

X. Provide: The materials and equipment described shall be furnished, installed and connected under this Division, complete for operation, unless specifically noted to the contrary. Identical to the phrase "furnish and install".

Y. PVC: Polyvinyl chloride plastic.

Z. RTU: Rooftop unit. The abbreviations means packaged, outdoor, central station AHUs. This abbreviation may be used regardless of whether the unit is located on a roof or at grade.

AA. VAV: Variable air volume.

BB. VFD: Variable frequency drive. This may be used interchangeably with VSD (variable speed drive), VSC (variable speed controller), and VFMC (variable frequency motor controller). This technology varies the frequency of the incoming electrical signal to change the speed of driven equipment.

1.4 RELATED REQUIREMENTS

A. All conditions imposed by these documents shall be applicable to all portions of the Work under this Division. These references are intended to point out specific items to the Contractor, but in no way relieve him of the responsibility of reading and complying with all relevant parts of the entire Specification.

B. The Contractor shall examine and coordinate with all Contract Drawings and Specifications, and all Addenda issued. Failure to comply shall not relieve them of responsibility. The omission of details of other portions of the Work from this Division shall not be used as a basis for a request for additional compensation.

C. The specific features and details for other portions of the Work related to the construction in progress or to the existing building(s) shall be determined by examination at the site.

1.5 RELATED REQUIREMENTS

A. All conditions imposed by these documents shall be applicable to all portions of the Work under this Division. These references are intended to point out specific items to the Contractor, but in no way relieve him of the responsibility of reading and complying with all relevant parts of the entire Specification.

1.6 ORDINANCES, PERMITS AND CODES

A. It shall be the Contractor's duty to perform the work and provide the materials covered by these Specifications in conformance with all ordinances and regulations of all authorities having jurisdiction.

B. All work herein shall conform to all applicable laws, ordinances, and regulations of the local utility companies.

C. The work shall be in accordance with, but not limited to, the requirements of:

1. National Fire Protection Association
2. City of Loveland Building Codes
3. State of Colorado Safety Code
4. State of Colorado Boiler Code
5. State of Colorado Department Of State Health Services

D. Codes and standards referred to are minimum standards. Where the requirements of these Specifications or drawings exceed those of the codes and regulations, the drawings, and Specifications govern.

E. The Contractor shall obtain permits, plan checks, connection and specification fees, inspections, and approvals applicable to the Work as required by the regulatory authorities.

F. Fees and costs of any nature whatsoever incidental to permits, inspections, and approvals shall be assumed and paid by the Contractor.

G. The pro-rata costs, if any, for utilities serving this property will be paid for by the Owner and shall not be included as part of this Contract.

1.7 REFERENCE STANDARDS

A. Where differences between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents occur, the most stringent shall govern. The Contractor shall promptly notify the Owner's Representative in writing of any such difference.

B. Should the Contractor perform any Work that does not comply with local codes, laws and ordinances, industry standards or other governing regulations, the Work shall be corrected on non-compliance deficiencies with the Contractor bearing all costs.

C. In addition to the aforementioned ordinances, industry standards published by the following organizations shall apply:

1. AIA - AMERICAN INSTITUTE OF ARCHITECTS
2. AABC - ASSOCIATED AIR BALANCE COUNCIL
3. AASHO - AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS
4. ACI - AMERICAN CONCRETE INSTITUTE
5. ADC - AIR DIFFUSION COUNCIL
6. AGA - AMERICAN GAS ASSOCIATION
7. AHRI - AIR CONDITIONING HEATING & REFRIGERATION INSTITUTE
8. AISC - AMERICAN INSTITUTE OF STEEL CONSTRUCTION
9. AMCA - AIR MOVING AND CONDITIONING ASSOCIATION
10. ANSI - AMERICAN NATIONAL STANDARDS INSTITUTE
11. API - AMERICAN PETROLEUM INSTITUTE

12. ASCE - AMERICAN SOCIETY OF CIVIL ENGINEERS
13. ASHRAE - AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS, INC.
14. ASME - AMERICAN SOCIETY OF MECHANICAL ENGINEERS
15. ASTM - AMERICAN SOCIETY FOR TESTING AND MATERIALS
16. AWSC - AMERICAN WELDING SOCIETY CODE
17. AWWA - AMERICAN WATER WORKS ASSOCIATION
18. CDA - COPPER DEVELOPMENT ASSOCIATION
19. CISPI - CAST IRON SOIL PIPE INSTITUTE
20. CTI - COOLING TOWER INSTITUTE
21. FGI - FACILITY GUIDELINES INSTITUTE
22. FMG - FACTORY MUTUAL GLOBAL
23. ICC - INTERNATIONAL CODE COUNCIL
24. IRI - INDUSTRIAL RISK INSURERS
25. NBS - NATIONAL BUREAU OF STANDARDS
26. NFPA - NATIONAL FIRE PROTECTION ASSOCIATION
27. OSHPD - OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
28. PDI - PLUMBING AND DRAINAGE INSTITUTE
29. SMACNA - SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION
30. UL - UNDERWRITER'S LABORATORIES

D. Where the Documents exceed the above requirements, the Documents shall govern. In no case shall Work be installed contrary to or below the minimum legal standards.

1.8 DRAWINGS AND SPECIFICATIONS

A. The inter-relation of the specifications, the drawings, and the schedules are as follows:

1. The specifications provide the written requirements for the quality, standard, nature of the materials, equipment and construction systems.
2. The drawings establish the quantities, approximate dimensions, details and location of equipment.
3. The schedules give the capacities, characteristics and components.

B. For any individual project, if there is conflict between the drawings and or specifications, they are equivalent in authority and priority. Should they disagree in themselves, or with each other, prices shall be based on the most expensive combination of quality and quantity of work indicated. In the event of the above mentioned disagreements the resolution shall be determined by the Architect.

C. Contractor is responsible to bring any conflicts in drawings and/or specifications to the attention of the Architect, immediately, prior to any work being done.

D. Review all construction details illustrated on the architectural and structural drawings and be guided thereby.

1.9 SUBMITTAL PROCEDURES

A. Simultaneous Action Submittals: When submittals are required and a simultaneous action is indicated, the equipment is to be coordinated across trades prior to forwarding to the Engineer.

1. The release of mechanical equipment submittals (pumps, air handling units, chillers, fans cooling towers, etc.) is dependent on the receipt of a complete and accurate overcurrent protective device coordination study as required by Division 26.
2. The Architect and Engineer require a full submittal review period as delineated in Division 01 Section "Submittal Procedures" to adequately review the OCPD study against the submitted electrical components prior to release of submittals for equipment procurement.
3. The submittal schedule required by Division 01 requirements shall provide for this review time in the action submittal process.
4. Delay claims arising due to Contractor's failure to coordinate simultaneous action submittals will not be considered by the Owner.

B. Documents for submittal may be hard copies in a three ring binder or soft copies in an electronic file using the Portable Document Format (PDF) standard. In any case, where multiple products, trades, floors, disciplines, etc. are combined into one (1) submittal, provide tabs for binders or 'bookmarks' for PDF files for efficient navigation between items to be reviewed and a table of contents at the front. Documents that do not conform may be rejected.

C. Common Requirements for Product Data: Where this Section and other Sections of this Division require Product Data to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Submit hardcopy of Product Data in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of product data submittals shall be bound materials as defined above. Separate products under distinct subheadings that correspond to paragraphs in specification text. Divide sections in binder with labeled divider tabs.
2. In addition to hardcopies required by Division 01, submit one copy of product data in electronic format. All files shall be in Portable Document Format (.pdf).
3. Product Data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.

D. Common Requirements for Shop Drawings: Where this Section and other Sections of this Division require Shop Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Prepare Shop Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®.
2. Submit hardcopy of Shop Drawings in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of Shop Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one (1) copy of Shop Drawings in electronic format. Files shall include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
4. Shop Drawings shall be of appropriate scale based on the following:

   a. Ductwork and Piping Systems, including all underfloor work: Minimum 1/8" = 1'-0".

      1) Double-line congested areas.
      2) Double-line duct widths greater than 24".

   b. Mechanical rooms: 1/4" = 1' – 0".

1) Double-line all systems.

c. Temperature Control Diagrams with Sequence of Operations on same drawing.

5. Shop drawings shall include the following items:

a. Concrete pads and foundations.
b. Equipment room layouts with actual dimensions and offsets for all systems.
c. Roof layouts.
d. Trench locations and sizes.
e. Dimensioned floor drain locations.

E. Common Requirements for Coordination Drawings: Where this Section and other Sections of this Division require Coordination Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" and Division 01 Section "Project Management and Coordination". In addition to the requirements of Division 01 comply with the following:

1. Prepare Coordination Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®. Drawings files must be composite with multiple distinctive layers for each of the various trades.
2. Submit hardcopy of Coordination Drawings in the quantity as required under Division 01. Hardcopies of Coordination Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one (1) copy of Shop Drawings in electronic format. Files shall include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
4. Coordination Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.

F. Coordination Drawings: Prepare drawings showing dimensioned layout for the following:

1. Penetration and Structural Opening: Floor plans showing sleeves and formed structural penetrations. Show sleeve and formed penetration layouts and relationships between structural components and other adjacent building elements, including but not limited to pre-tensioning and post-tensioning members where used.
2. Reflected Ceiling Plans: ceiling plans, sections, and other necessary details showing dimensioned layouts for equipment located in or on the ceiling plane. Base dimensions on exact dimensioned data obtained from product submittals for products to be included in the Work. Differentiate between field measurements and assumed dimensions. Include the all items in the ceiling plane coordinated with each other, based on input from installers of the items involved.
3. Include the following items coordinated with each other, based on input from installers of the items involved:

a. Suspended ceiling components.
b. Structural members to which suspension systems for luminaires will be attached.
c. Perimeter moldings, decorative ceiling elements, and Architectural features.
d. Luminaires.
e. HVAC Diffusers, Registers and Grilles.
f. Speakers.
g. Sprinklers.
h. Fire Alarm initiating devices, including but not limited to the following:

1) Smoke detectors.

2) Heat detectors.

i. Fire Alarm notification appliances.
j. Occupancy sensors.
k. Access panels.
l. Security cameras and occupancy detectors.
m. Wireless Access Points.
n. Wiring Diagrams
o. Short-circuit current rating of equipment assembly.
p. Nurse Call Zone and Dome Lights.
q. Patient Telemetry Receivers and Equipment.

4. HVAC Layouts:

a. Single-line drawings of duct and piping systems are satisfactory except for the following, which shall be double-lined:

1) All mechanical equipment rooms.
2) Main duct runs to and from air handling equipment rooms.
3) Ductwork and piping in congested areas.
4) Ductwork with widths 36″ and greater.

b. Shop drawings shall be provided for the following:

1) Sheet Metal and Duct Systems, including all underfloor work (prepared at a minimum scale of 1/8"=1'-0")
2) Piping and equipment systems for chilled water, condenser water, refrigerant, heating water, steam and other HVAC piping systems. (Preferably at 1/4" = 1' – 0" and not less than 1/8" = 1' – 0").
3) Equipment room layouts with actual equipment, piping, and duct at 1/4" = 1' – 0" scale. Show clearances, access spaces, relative heights of piping, main ducts, outside and relief louvers. Provide at least one (1) section through each equipment room showing the same.
4) Temperature Control Diagrams with Sequence of Operations on same drawing.
5) Housekeeping and equipment concrete pads.
6) Dimensioned floor drain locations and the equipment each serves.
7) Roof layouts.
8) Trench locations and sizes.
9) Catwalk or equipment maintenance platform assemblies.

c. Equipment support locations, type of support, and weight on each support.
d. Location of structural supports for structure-supported raceways.
e. For floor mounted equipment: concrete base dimension, outline of equipment, and required clearances.

G. Common Requirements for Specification Compliance Certification: Where this Section and other Sections of this Division require Specification Compliance Certification to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" for "Other Informational Submittals". In addition to the requirements of Division 01 comply with the following:

1. Prepare a line-by-line Specification Compliance Certification by marking up a copy of the Contract Document specification section in the left margin. Accompany the markup with a written report explaining all items that are not marked with "Compliance". Submit line-by-line markup, written report of deviations and alternates and a cover letter certified by Manufacturer or Installer that prepared the Specification Compliance Certification. Use the following key for preparing the line-by-line markup.

    a. "C" for Compliance: By noting the term "compliance" or "C" in the margin, it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
    b. "D" for Deviation: By noting the term "deviation" or "D" in the margin, it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified.
    c. "A" for Alternate: By noting the term "alternate" or "A" in the margin, it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner.
    d. "N/A" for Not Applicable: By noting the term "not applicable" or "N/A" in the margin, it shall be understood that the specified item is not applicable to the project.

H. Common Requirements For Qualification Data:

1. Professional Engineer Qualifications: Where this Section and other Sections of this Division require a licensed Professional Engineer to be responsible for Delegated Design requirements; Submit Qualification data for Professional Engineer including, but not limited to, proof of licensing registration in the state where the Project is located.
2. Independent Testing and Inspecting Agency Certification: Where this Section and other Sections of this Division require an Independent Testing and Inspecting agency to be responsible for Acceptance Testing and Field Quality Control requirements; submit certification documentation for such agency that demonstrates compliance with the Quality Assurance paragraph of this Section.

I. Qualification Data: For Independent Testing and Inspecting Agency.

J. Welding certificates.

1.10 PRODUCT SUBSTITUTIONS

A. Comply with provisions of Division 01 Section "Product Substitution Procedures".

1. If item of equipment or device offered as Substitution differs in dimension or configuration from that indicated in the Contract Documents, provide, as part of the substitution submittal, a drawing that shows that the equipment or devices proposed for Substitution can be installed in the space available without interfering with other trades or with access requirements for operations and maintenance in the completed project. Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.
2. Where substitute equipment or devices requires different arrangement or connections from that indicated in the Contract Documents, install the equipment or devices to operate properly and in accordance with the requirements of the Contract Documents. Make incidental changes necessary in piping, ductwork or wiring which results from the inclusion of the substitute equipment or device without any additional cost to the Owner. Pay all additional costs incurred by other trades in connection with changes required by the inclusion of the substituted equipment or device in the Work.

3. When submitting a manufacturer that is not the Basis of Design, the Contractor shall provide an itemized list of all deviations from and compliances with the information detailed in both the specification section and schedule. An additional itemized list shall account for scope increase and deductions based on substitutions for the following minimum items:

    a. Electrical panels, distribution, and safeties.
    b. Structural modifications.
    c. Civil modifications.
    d. Plumbing modifications.
    e. Duct and pipe connections or arrangements.
    f. Space heating and cooling requirements.
    g. Exhaust or ventilation modifications.
    h. Vibration isolation requirements.

B. Manufacturers not listed are subject to design Engineer's review and may not be acceptable. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum ten (10) business days prior to bid with each sub-paragraph noted with the comment, "compliance", "deviation", "alternate" or "not applicable" as described above. In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.

C. Where substitute products or materials requiring different arrangement or connections from that indicated are accepted by the Owner's Representative, install the equipment or devices to operate properly and in harmony with the intent of the Documents, making all incidental changes in piping, ductwork, wiring, and any other trade resulting from the substitution without any additional cost to the Owner.

D. The Owner's Representative reserves the right to call for samples of any item of product or material offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.

E. When any request for a substitution of a product or material is submitted and rejected, the item named in the Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

1.11 QUALITY ASSURANCE

A. All Work shall be performed by properly licensed technicians skilled in their respective trades. All materials, equipment and devices shall be installed in accordance with the recommendations of the manufacturer and in the best standard practice to bring about results of a first class condition.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

    1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
    2. Certify that each welder has passed AWS qualification tests for welding processes involved in the systems they are working on and that certification is current.

D. Electrical Characteristics for HVAC Equipment:

1. Equipment having higher electrical characteristics other than those specified should be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
2. Where variable frequency drives are provided for equipment, whether installed separately or integral to the equipment, the VFDs shall conform to Division 26 Section, "Variable Frequency Motor Controllers".

E. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided on this project shall meet the requirements of the UL standard in every way, and shall be UL listed and labeled.

F. Products and materials shall be of the best quality customarily applied in quality commercial practice, and shall be by reputable manufacturers.

G. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.

H. Products and materials provided under this Division of the Specifications shall be essentially the standard item, unless otherwise noted, of the specified manufacturer, or where allowed, an alternate manufacturer.

I. Common Requirements for Independent Testing and Inspecting Agency Qualifications: Where this Section and other Sections of this Division call for an Independent Testing and Inspecting Agency (Testing Agency); the Testing Agency shall comply with the following requirements:

1. Have the experience and capability to conduct the testing indicated,
2. Be a nationally recognized testing laboratory (NRTL).
3. Meet the following:

   a. Be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated.
   b. Use technicians who are regularly employed for testing services.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver products and materials with factory-applied end caps or "heat shrink" wrappings to protect openings. Maintain opening protection through shipping, storage, and handling to prevent damage and the entrance of dirt, debris, and moisture.

B. Store light sensitive products and materials away from and protected against direct sunlight.

C. Support products and materials at all times to prevent sagging and bending.

D. The area provided for product and material storage at the jobsite shall be clean, dry and exposure to dust minimized.

E. Responsibility for the protection of products and materials shall extend to existing equipment, systems, and products and materials. Erect temporary sheltering structures, provide temporary bracing and supports, or cover existing equipment, systems, and products and materials to prevent damage and the entrance of dirt, debris, and moisture.

F. Failure on the part of the Contractor to comply with the above to the satisfaction of the Architect, Engineer, or either's authorized representative shall be sufficient cause for the rejection of products and materials in question.

1.13 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces.

D. Installation Drawings

1. Prepare special drawings as called for elsewhere herein or directed by the Architect to coordinate this work with the work of other Divisions, to illustrate changes in this work to facilitate its concealment in finished spaces, to avoid obstructions, or to illustrate the installation of a substitute equipment item.
2. Use these drawings in the field for the installation of all systems and components. Unless otherwise directed, do not submit these drawings for review, but provide 3 copies to the Architect for information.

E. ACTION SUBMITTALS

1. Product Data: For the following:

a. Dielectric fittings.
b. Mechanical sleeve seals.
c. Escutcheons.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. All piping and tubing shall be American manufactured, unless otherwise indicated.

2.2 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

## 2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

## 2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

   a. Innerlynx.
   b. Link-Seal by PSI.
   c. Metraflex Co.

2. Sealing Elements: EPDM for high temperature applications and NBR for all others unless otherwise indicated, interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe. Seal shall be same manufacturer as sleeve.
3. Pressure Plates: Stainless steel. Include two (2) for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one (1) for each sealing element.

2.5 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 10, galvanized, plain ends.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Cast-Brass Type: With set screw.

   1. Finish: Polished chrome-plated and rough brass, pending approval by Architect.

C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

   1. Finish: Polished chrome-plated and rough brass, pending approval by Architect.

D. One-Piece, Floor-Plate Type: Cast-iron floor plate.

E. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

   1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SCOPE OF WORK

A. Inspection of Site

   1. The accompanying drawings do not indicate existing mechanical installations other than to identify modifications of and extensions thereof. Site visits and installation inspections to ascertain the conditions to be met are included in the scope.

2. Failure to comply with an inspection of the site shall not constitute ground for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work under this Division.
3. Review construction details of the existing portion of the building during the site inspection and include all work required to modify the existing mechanical installations and install new materials, comprising a part of the mechanical installation, within the present structure.
4. Review all construction details of the new portion of the building as illustrated on the architectural and structural drawings and be guided thereby.

B. Products and Materials Description

1. Where two (2) or more units of the same kind or class of a specific item are required, these shall be the products of a single manufacturer; however, the component parts of the item need not be the products of one (1) manufacturer.
2. In describing the various products and materials, in general each item will be described singularly, even though there may be a multiplicity of identical items. Also, where the description is only general in nature, exact sizes, duties, space arrangements, horsepower requirements and other data shall be determined by reference to the Documents.

C. The Work shall include modifications and extensions to existing systems, and the modification of the existing structure as required accommodating the installation of the Work.

D. Refer to other Divisions of the Specifications for related Work.

E. Install, hang, support, etc. all MEP systems and equipment to satisfy all requirements of the applicable design criteria for project site as indicated by Architect.

F. It is the intent, unless otherwise indicated, that all products and materials described and specified under this Division, shall be provided for a complete working system irrespective of use of the phrases "install", "furnish", "furnish and install", or "provide" as described above has been actually included.

G. The Contractor is responsible for all Work of every description in connection with this Division of the Specifications.

H. The Contractor specifically and distinctly assumes all risk for damage or injury from whatever cause to property or person used or employed on or in connection with this Work and of all damages or injury to any person or property wherever located, resulting from an action or operation under the Contract in connection with the Work, and undertake the promise to defend the Owner against all claims on account of any such damage or injury.

I. The Contractor will be held responsible for the satisfactory execution and completion of the Work in accordance with the true intent of the Documents.

J. Provide without extra charge all incidental items required as part of the Work, even though it may not be specifically indicated. If the Contractor has reason for objecting to the use of any material, equipment, device or method of construction as indicated, he shall make report of such objections to the Owner's Representative, obtain proper approval and adjustment to the Contract, and shall proceed with the Work.

K. Electrical Installation

1. All electric wiring shall be installed under Division 26, except for such equipment items as are prewired at their point of manufacture and so delivered to the project, and except for the following:

   a. Temperature Control Wiring and Power Wiring provided by controls contractor.

2. Prepare and submit for review wiring diagrams for all equipment furnished under this Division. Show on these diagrams all power, interlock, and control circuits. When the Architect takes no exception to these drawings, they shall become installation drawings for the Contractor.
3. All chilled water, condenser water piping, domestic cold and hot water piping, and wet fire protection system shall be heat traced when routed external to the building or in areas susceptible to freezing conditions.

3.2 Schedule And Sequence Of Work

A. The Contractor shall meet and cooperate with the Owner and Owner's Representative to schedule and sequence Work so as to ensure meeting scheduled completion dates and avoid delaying other portions of the Work. Work requiring special sequencing shall be at no additional cost to the Owner and shall have no impact on the schedule.

B. Work schedules and completion dates as established shall be rigidly adhered to. Cooperate in establishing these schedules and perform the work under this Division at such times as directed so as to ensure meeting scheduled dates and avoid delaying any other Contractor.

C. The facility will continue to be in use throughout the construction period, and the schedule contemplates working in designated areas in the present facility while other adjacent areas are occupied. Execute work in this Division to minimize disturbance to occupants in adjacent areas.

D. When any work affects any services to any occupied area new permanent or temporary services, or a combination of both, shall be installed to enable occupied areas to function properly. Additional valves required shall be installed without added cost to the Owner.

E. Perform no work in the present facility that interferes with normal hours of occupancy, unless special permission is granted by the Owner. Included are operations which would cause objectionable noise or service interruptions. Each discipline shall coordinate their work with the established phases of construction.

F. Any work involving a service suspension shall be scheduled in advance with the Owner.

G. Should it be necessary to perform certain operations on an "overtime" basis in order not to interrupt the normal usage of the facility, include the costs of such overtime without change in the Contract amount.

3.3 TEMPORARY HEATING AND COOLING

A. Provide all temporary heating and cooling equipment for spaces that require continued use.

B. Should the work in the designated areas affect any services to areas that are to remain in use, provide temporary services as required to enable those occupied areas to function properly. Additional valves, ductwork, equipment and piping required shall be installed without added cost to the Owner.

3.4 HVAC DEMOLITION

A. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.5 SALVAGED MATERIALS

A. Reuse no salvaged material except as noted on the Drawings, specified herein, or directed by the Architect. Remove from the premises all present materials falling under this Division, which are removed from the existing building. Upon completion, leave no "dead" line or equipment installed in any portion of the area being remodeled, unless otherwise indicated.

3.6 ACCESS – COMMON REQUIREMENTS

A. Provide an access door in non-lay-in ceilings to maintain and inspect HVAC components. Components include, but are not limited to, the following:

1. Actuators.
2. Control Modules.
3. Filter Boxes.
4. Fire Protectives.
5. Manual balancing dampers.
6. Terminal boxes.
7. Valves.

B. Unless otherwise indicated, access door shall provide a minimum clear opening of 30" x 30".

3.7 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons, after Architect's final approval of finish, for penetrations of walls, ceilings, and floors according to the following:

1. New piping penetrations shall be one-piece escutcheons.
2. Existing piping penetrations shall be two-piece escutcheons.
3. All sleeved penetrations shall be deep-drawn allow flush installation between escutcheon and finished surface.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board rated partitions, and concrete floor and roof slabs.

1. Penetration assemblies shall comply with U.L. Fire Resistance Directory requirements for wall penetrations.

2. Cut sleeves to length for mounting flush with both surfaces, unless otherwise indicated.

a. Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level to prevent water entrance into sleeved hole. Vertical pipe supports must be extended to and be supported by the floor rather than the sleeve.
b. Provide concrete pipe curb in floors of mechanical equipment areas or other wet areas 4 inches above finished floor level, minimum, in lieu of extended sleeves.

3. Install sleeves in new walls and slabs as new walls and slabs are constructed.

4. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

5. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

N. Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter for above ground locations.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter for above ground and all underground locations.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

## 3.8 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. 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.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.9 PIPING CONNECTIONS

A. 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. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.10 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Equipment called for on the plans and not listed herein shall be provided as though it were fully described herein.

B. Equipment called for herein shall be completely provided, whether fully detailed or not on the plans, and/or scheduled.

C. All equipment as indicated on the plans and as described herein shall be installed per manufacturer's recommendations to allow for proper operation and maintenance of the equipment.

D. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

E. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

F. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

G. Where any piece of equipment is too large for ingress through normal building openings, it shall be placed in its containing space before the enclosing structure is completed.

H. Install equipment to allow right of way for piping installed at required slope.

3.11 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.12 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.

1. Construct concrete bases not less than 4 inches larger in both directions than supported unit.
2. Concrete bases for internally isolated AHU's shall be 6 inches (150 mm) tall above finished floor.
3. Concrete bases for all other equipment shall be 4 inches (100 mm) tall above finished floor.

3.13 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.14 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.15 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.16 INSTALLATION INSPECTIONS AND CERTIFICATIONS

A. The Contractor shall obtain timely inspections of the installation by the constituted authorities. Remedy any deficiencies to the satisfaction of the inspecting authority.

B. Upon final completion of the work, obtain certificates of acceptance from the constituted authorities. Deliver the certificates to the Architect for transmission to the Owner.

3.17 OPERATION PRIOR TO COMPLETION

A. When any piece of mechanical or electrical equipment is operable and it is to the advantage of the contractor to operate the equipment, he may do so with permission of Owner, providing that he properly supervises the operation, retains full responsibility for the equipment operated, and protects against dirt accumulations during operation. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner or until final acceptance by the Owner.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, and properly adjust the operation of the equipment before final acceptance by the Owner.

C. All equipment is to be maintained per the manufacturer's instructions until Owner's maintenance staff is responsible for operation and upkeep.

3.18 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers and/or technicians acceptable to the Owner's Representative to instruct other representatives of the Owner in the complete and detailed operation of each item of equipment or device of all the various electrical systems. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results.

B. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

C. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given the Owner's personnel and the letter of release acknowledged.

D. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals.

E. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturer's operating and maintenance instructions, parts lists (with sources identified), and other data as appropriate for each system.

3.19 SEALANT

A. Apply sealant to penetrations of all floor and wall assemblies to maintain pressure differentials required by AIA, DSHS, CDC or CMC for all pressure sensitive rooms.

B. Pressure sensitive rooms include, but are not limited to:

1. Pharmacy including Chemo Prep, Sterile Prep and Ante rooms.

C. Sealant materials and installation requirements are specified in Division 07 Section "Joint Sealants" and Division 09 Section "Gypsum Board Assemblies.

END OF SECTION

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# PART 1 - GENERAL

## 1.1 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.

B. Related Sections include the following:

1. Division 26 Section "Enclosed Controllers".
2. Division 26 Section "Variable Frequency Motor Controllers".

## 1.2 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.

## 1.3 WARRANTY

A. All inverter-duty motors shall have minimum 5-year warranty.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. MagneTek/Century

B. Lincoln

C. Marathon

D. General Electric

E. Gould

F. Toshiba

G. Baldor

H. Reliance

I. US Motors

2.2 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.3 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.

2.4 POLYPHASE MOTORS

A. Description: ¾ hp and larger NEMA MG 1, Design B, medium induction motor, unless otherwise indicated.

B. Efficiency: Provide premium efficiency type for all motors 1 HP and greater and conform to the minimum efficiencies as listed in ASHRAE 90.1-2013.

C. Service Factor: 1.15.

D. Rotor: Random-wound, squirrel cage.

E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating.

G. Insulation: Class F.

H. 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.

I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

J. Provide shaft grounding rings.

2.5 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. Spike-proof inverter motor such that voltage spikes will not damage motor insulation.
2. No distance restrictions between any inverter and motor.
3. No frequency limitations.
4. Inverter power conditioning equipment shall not be required to protect motor.

C. 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.

1. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
3. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.6 SINGLE-PHASE MOTORS

A. Motors less than ¾ hp shall be one of the following to suit starting torque and requirements of specific motor application, unless noted otherwise:

B. Permanent-split capacitor.

1. Split phase.
2. Capacitor start, inductor run.
3. Capacitor start, capacitor run.

C. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

D. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

E. Motors 1/20 HP and Smaller: Shaded-pole type.

F. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.7 MOTOR ENCLOSURES

A. Provide motor enclosures according to the following list as a minimum, unless recommended by the manufacturer for the given application or unless indicated otherwise.

1. Indoor Service: ODP type.
2. Outdoor Service: TEFC type.
3. Inside an Air Stream: For fan motors installed in the air stream by the fan manufacturer the motor enclosure shall be TEAO unless indicated otherwise by the manufacturer.
4. Hazardous Service: For NEC hazardous locations motor enclosures shall be rated for the division, class, and group indicated or required.

PART 3 - EXECUTION

3.1 STARTER AND MOTOR CONTROLS

A. Provide a suitable NEMA rated starter, one per motor, for control of each motor furnished under this Division. All motors 3/4 horsepower and larger require magnetic or electronic starters, no exceptions. All motors of any size that are automatically controlled require "Hand-Auto" or "Hand-off-Auto" magnetic or electronic starters, no exceptions. All magnetic and electronic starters shall have H-O-A switches.

B. Provide each motor that does not require a starter, a manual starting switch with thermal overload protection with identifying nameplate, green pilot light and stainless steel cover plate equal to Westinghouse Type MS. Switches installed on finished walls shall be flush type.

C. Starter shall have overload protection on all phases. This will require three overload relays for three phase motors and one overload relay for one phase/line voltage motor. Provide NEMA 1B control voltage transformer, "on" green pilot light, and 1-normally open and 2-normally closed auxiliary contacts on each starter, unless otherwise noted.

D. Certain starters and motor controls for motors furnished under this Division are scheduled on the Drawings to be elements of motor control centers provided under Division 26. Except for those scheduled starters, provide a suitable starter for control of each motor furnished under this Division.

E. Each starter shall have a capacity rating within the required limits of the motor which it serves; it shall have overload elements selected to provide protection for the motor.

F. Where a combination starter and disconnect switch or starter and circuit breaker in a common enclosure is scheduled, provide auxiliary contacts on the switch or breaker as required to assure that, when the disconnecting means is open, there are no "live" contact points on the starter.

G. Where a holding coil voltage differs from line voltage, install a transformer with secondary fusing in the starter enclosure.

H. Unless otherwise indicated, furnish starters mounted indoors with NEMA Type 1 enclosures; and furnish those exposed to the weather with NEMA Type 3R enclosures.

I. Where starters are not installed in heated and cooled spaces, the heater elements shall be of the ambient temperature-compensated, bimetallic type.

END OF SECTION 230513

# PART 1 - GENERAL

## 1.1 SUMMARY

A. Section Includes:

1. Flexible-hose expansion joints.

## 1.2 DEFINITIONS

A. BR: Butyl rubber.

B. Buna-N: Nitrile rubber.

C. CR: Chlorosulfonated polyethylene synthetic rubber.

D. CSM: Chlorosulfonyl-polyethylene rubber.

E. EPDM: Ethylene-propylene-diene terpolymer rubber.

F. NR: Natural rubber.

G. PTFE: Polytetrafluoroethylene plastic.

## 1.3 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.

B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

## 1.4 ACTION SUBMITTALS

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

B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and bends.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

## 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pipe expansion joints to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

A. Flexible-Hose Expansion Joints: Manufactured assembly with two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose; with inlet and outlet elbow fittings, corrugated-metal inner hoses, and braided outer sheaths.

1. Manufacturers:

a. Flex-Hose Co., Inc.
b. Flexicraft Industries.
c. Flex-Pression, Ltd.
d. Metraflex, Inc.

2. Flexible-Hose Expansion Joints for Copper Piping: Copper-alloy fittings with solder- joint end connections.

a. NPS 2 and Smaller: Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
b. NPS 2-1/2 to NPS 4: Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.

3. Flexible-Hose Expansion Joints for Steel Piping: Carbon-steel fittings with threaded end connections for NPS 2 and smaller and flanged end connections for NPS 2-1/2 and larger.

a. NPS 2 and Smaller: Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
b. NPS 2-1/2 to NPS 6: Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.

2.2 ALIGNMENT GUIDES

A. Description: Steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.

1. Manufacturers:

a. Adsco Manufacturing, LLC.
b. Advanced Thermal Systems, Inc.
c. Flex-Hose Co., Inc.
d. Flexicraft Industries.
e. Flex-Weld, Inc.
f. Hyspan Precision Products, Inc.
g. Metraflex, Inc.
h. Piping Technology & Products, Inc.
i. Senior Flexonics, Inc.; Pathway Division.

2.3 MATERIALS FOR ANCHORS

A. Steel Shapes and Plates: ASTM A 36/A 36M.

B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.

C. Washers: ASTM F 844, steel, plain, flat washers.

D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.

1. Stud: Threaded, zinc-coated carbon steel.
2. Expansion Plug: Zinc-coated steel.
3. Washer and Nut: Zinc-coated steel.

E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application.

1. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
2. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
3. Washer and Nut: Zinc-coated steel.

F. Concrete: Portland cement mix, 3000 psi minimum. Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.

G. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink, 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 EXPANSION-JOINT INSTALLATION

A. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."

B. Install expansion joints of sizes matching size of piping in which they are installed.

C. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.

### 3.2 ALIGNMENT-GUIDE INSTALLATION

A. Install guides on piping adjoining pipe expansion fittings and loops.

B. Attach guides to pipe and secure to building structure.

### 3.3 ANCHOR INSTALLATION

A. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.

C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.

D. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints or compensators are indicated.

E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

END OF SECTION 230516

# PART 1 - GENERAL

## 1.1 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gauges.
3. Test plugs.
4. Flowmeters.

## 1.2 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene propylene diene monomer rubber.

## 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Shop Drawings: Schedule for thermometers, gauges, and flowmeters indicating manufacturer's number, scale range, and location for each.

## 1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of thermometer, gauge, and flowmeters signed by product manufacturer.

## 1.5 CLOSEOUT SUBMITTALS

A. A. Operation and Maintenance Data: For meters and gauges to include in operation and maintenance manuals.

## 1.6 EXTRA MATERIALS

A. Provide a PT measurement kit with thermometers and gauges chosen to indicate system pressures and temperatures at mid-scale. Provide multiple of each as mid-scale measurement dictates.

# PART 2 - PRODUCTS

## 2.1 THERMOMETERS

A. Digital Vari-angle Thermometer, self-powered and within 1% accuracy, **Equal to** Weiss Model DVU35.

1. Case: Hi-impact ABS

2. Range: -40/300 °F (-40/150 °C)
3. Display: 3/8" LCD digits, wide ambient formula
4. Accuracy: 1% of reading or 1° whichever is greater
5. Resolution: 1/10° between -19.9/199.9 °F (-28/93 °C)
6. Recalibration: Internal potentiometer
7. Lux Rating: 10 Lux (one foot-candle)
8. Update Rate: 10 seconds
9. Ambient Operating Range: -30/140 °F (-35/60 °C)
10. Ambient Temp. Error: Zero
11. Humidity: 100%
12. Sensor: Glass passivated thermistor
13. Connector: Adjustable Angle

2.2 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, socket-type 304 Stainless Steel fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.3 PRESSURE GAUGES

A. Manufacturers:

1. Ernst Gauge Co.
2. Miljoco Corp.
3. Trerice, H. O. Co.
4. Weiss Instruments, Inc.
5. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
6. Dwyer Instruments, Inc.

B. Direct-Mounting, Dial-Type Pressure Gauges: Indicating-dial type complying with ASME B40.100.

1. Case: Dry type, cast aluminum, 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or Black metal.
7. Window: Glass.
8. Ring: Stainless steel.
9. Accuracy: Grade B, plus or minus 2 percent of middle half scale.
10. Vacuum-Pressure Range: 0 to 50 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gauge Fittings:

1. Valves: NPS 1/4 brass or stainless-steel ball type.
2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.4 TEST PLUGS

A. anufacturers:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
7. Watts Industries, Inc.; Water Products Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.

2.5 TURBINE FLOWMETERS

1. Turbine flowmeters can be used with a transmitter to send signals to a remote meter terminal.

B. Manufacturers:

1. Badger Meter, Inc.; Industrial Div.
2. Bailey-Fischer & Porter Co.
3. Data Industrial Corp.
4. Fischer, George Inc.
5. ONICON Incorporated.

C. Description: Insertion type for inserting turbine into piping and measuring flow directly in gallons per minute.

D. Construction: Bronze or stainless-steel body; with plastic turbine or impeller and integral direct-reading scale.

E. Pressure Rating: 150 psig minimum.

F. Temperature Rating: 180 deg F minimum.

G. Display: Visual instantaneous rate of flow, with register to indicate total volume in gallons.

H. Accuracy: Plus or minus 2-1/2 percent.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install digital thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler and chiller.
3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
4. Inlet and outlet of each hydronic heat exchanger.

B. Install thermometers in separable sockets at each additional location indicated on the Drawings or specified elsewhere herein, and/or as a standard.

C. Provide the following temperature ranges for thermometers, unless otherwise indicated:

1. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions
2. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.

3.2 GAUGE COCK APPLICATIONS

A. Install test plugs adjacent to all control sensors (except Insertion Type Flow Meters) installed in piping systems.

B. Valved pressure gauge connections shall be installed in each location indicated on the Drawings and/or specified elsewhere herein.

C. Install each gauge cock on a nipple of sufficient length so that the cock handle will be free of the pipe insulation. Position each cock so that a 4-1/2" diameter dial gauge may be easily read and screwed into and out of the cock.

D. On pumps use a single pressure gauge connected by ball valves and metal tubing to the inlet and discharge flanges as well as the suction diffuser inlet flange, if applicable.

E. Install gauge cocks at each pump as close to pump suction and discharge connections as practicable. Use any gauge connections provided in the pump casing.

3.3 GAUGE APPLICATIONS

A. Install dry-case-type pressure gauges at the following locations:

1. Discharge of each pressure-reducing valve.
2. At each steam connection to a heat exchanger in the mechanical equipment rooms.

B. On pumps use a single pressure gauge connected by ball valves and metal tubing to the inlet and discharge flanges as well as the suction diffuser inlet flange, if applicable.

C. Furnish and install calibrated pressure gauges at each location indicated on the Drawings, specified elsewhere herein, and/or as a standard.

3.4 INSTALLATIONS

A. Install thermometers and adjust vertical and tilted positions.

B. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated. Install thermowells using thermally conductive grease.

C. Install direct-mounting pressure gauges in piping tees with pressure gauge located on pipe at most readable position.

D. Install ball-valve and snubber or syphon fitting in piping for each pressure gauge for fluids (except steam).

E. Install needle-valve and siphon fitting in piping for each pressure gauge for steam.

F. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.

G. Install flowmeter elements in accessible positions in piping systems.

H. Install flowmeter elements with at least (10) pipe diameters minimum straight lengths of pipe upstream and (5) pipe diameters downstream from element as prescribed by manufacturer's written instructions.

I. Install flowmeters at discharge of hydronic system pumps and at inlet of hydronic air coils, as indicated.

J. Install test plugs adjacent to all gauges and control sensors (except insertion type flow meters) installed in piping systems.

3.5 CONNECTIONS

A. Install meters and gauges adjacent to machines and equipment to allow service and maintenance for meters, gauges, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Install test plugs adjacent to the temperature sensing device used for controls for simultaneous reading with test instrument for calibration purposes.

3.6 ADJUSTING

A. Calibrate meters according to manufacturer's written instructions, after installation.

END OF SECTION 230519

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following general-duty valves:

1. Copper-alloy ball valves.
2. Ferrous-alloy ball valves.
3. Ductile-iron butterfly valves.
4. Bronze check valves.
5. Cast-iron swing check valves.
6. Bronze globe valves.
7. Cast-iron globe valves.

B. Related Sections include the following:

1. Division 21 fire-suppression piping and fire pump Sections for fire-protection valves.
2. Division 23 Sections for specialty valves applicable to specific services only.
3. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and charts.
4. Division 23 Section "Instrumentation and Control for HVAC" for actuators in control valve applications.
5. Division 23 Section "Hydronic Piping" for additional valves and fittings.

## 1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. HPS: High-pressure Steam. Any system pressure above 15 psig is HPS.

D. LPS: Low-pressure Steam. Any system pressure less than or equal to 15 psig is LPS.

E. NRS: Nonrising stem.

F. OS&Y: Outside screw and yoke.

G. PTFE: Polytetrafluoroethylene plastic.

H. Single Flange: Any valve design where lugs are evenly spaced around the circumference of the valve face and attach to adjoining piping using full length bolts.

I. Spring-loaded, Lift-disc Check Valve: Non-slam check valve.

J. SWP: Steam working pressure.

K. TFE: Tetrafluoroethylene plastic.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated. Include body the following:

1. Seating, and trim materials
2. Valve design
3. Pressure and temperature classifications
4. End connections
5. Arrangement
6. Dimensions
7. Required clearances.
8. Include list indicating valve and its application by system and size.
9. Include rated capacities
10. Shipping, installed, and operating weights
11. Furnished specialties
12. Accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each valve include operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

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 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Copper-alloy Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated. All valves shall comply with recognized industry standards such as MSS SP-80 and SP-110.

C. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:

1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Gear Drive: Enclosed worm gear.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: Clamp lock.
5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

G. Valves in Insulated Piping: Valves shall have 3-inch stem extensions and the following features:

1. Gate Valves: Shall be rising-stem type.
2. Ball Valves: Shall have extended operating handle of non-thermal-conductive material, protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation, and memory stops that are fully adjustable after insulation is applied.

   a. Conbraco Industries, Inc.; Apollo Div.
   b. Jamesbury, Inc.
   c. Kitz Insulated Stem Extension Model #ISE 1 thru 4
   d. NIBCO Nib-seal handle extension

3. Butterfly Valves: Shall have extended necks.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

I. Valve Grooved Ends: AWWA C606.

J. Solder Joint: With sockets according to ASME B16.18.

1. Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.

K. Threaded: With threads according to ASME B1.20.1.

L. Valve Bypass and Drain Connections: MSS SP-45.

2.2 COPPER ALLOY BALL VALVES

A. Brass Ball Valves, General: MSS SP-110 and have a brass body complying with ASTM B 283.

B. Bronze Ball Valves, General: MSS SP-110 and have a copper alloy body complying with ASTM B 584, except for Class 250 which shall comply with ASTM B 61, full-depth ASME B1.20.1 threaded or solder ends, and blowout-proof stems.

C. Two-Piece, Full-Port, Copper Alloy Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel vented ball and stem, reinforced TFE seats, threaded body packnut design, blow-out proof stems, with adjustable stem packing, soldered or threaded ends; 150 psig SWP and 600-psig CWP ratings.

1. Conbraco Industries, Inc.; Apollo Div.
2. Jamesbury, Inc.
3. Kitz Model #68M or #69M
4. NIBCO Model S-585-70-66 or T-585-70-66

D. Two-Piece, Full-Port, 250 psig SWP, Copper Alloy Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel vented ball and stem, carbon-filled TFE seats, threaded body packnut design, blow-out proof stems, with adjustable stem packing, threaded ends; 250 psig SWP and 600-psig CWP ratings.

1. Conbraco Industries, Inc.; Apollo Div.
2. Jamesbury, Inc.
3. Kitz Model #68PM
4. NIBCO Model T-585-70-66-ST

E. Three-Piece, Full Port, Copper Alloy Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel vented ball and stem, threaded body packnut , blow-out proof stems, with adjustable stem packing, stainless nuts and bolts on valve body, soldered or threaded ends; 150 psig SWP and 600-psig CWP rating.

1. Conbraco Industries, Inc.; Apollo Div.
2. Jamesbury, Inc.
3. Kitz Model #62M or #63M
4. NIBCO Model S-595-Y-66-SS or T-595-Y-66-SS

2.3 FERROUS-ALLOY BALL VALVES

A. Ferrous-Alloy Ball Valves, General: MSS SP-72, with ASTM A-216 Type WCB, carbon-steel body; ASTM A-351, Type CF8M vented stainless-steel ball; and ASTM A-276, Type 316 stainless-steel stem; fire rated according to API 607 (4th edition); and having flanged ends and blowout-proof stem.

B. Class 150, Full-Port, Ferrous-Alloy Ball Valves: Split-body construction, carbon-filled TFE seats; 285 psig CWP rating.

1. Conbraco Industries, Inc.; Apollo Div.
2. Jamesbury, Inc.
3. Kitz 150SCTDZM-FS
4. NIBCO Model F-515-CS-F-66-FS

C. Class 300, Full-Port, Ferrous-Alloy Ball Valves: Split-body construction, carbon-filled TFE seats; 720 psig CWP rating.

1. Conbraco Industries, Inc.; Apollo Div.
2. Jamesbury, Inc.
3. Kitz 300SCTDZM-FS
4. NIBCO Model F-535-CS-F-66-FS

2.4 FERROUS-ALLOY BUTTERFLY VALVES

A. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, for bubble-tight shutoff, extended-neck for insulation, disc and lining suitable for potable water, unless otherwise indicated, and with the following features:

1. Full lug, grooved and flanged valves shall be suitable for bi-directional dead end service at full rated pressure without the use or need of a downstream flange. Valves NPS 12 and smaller shall not have exposed stem to disc fasteners and no exterior mounted fasteners to hold the liner.
2. Valve sizes NPS 2 through NPS 6 shall have lever lock operator; valve sizes NPS 8 and larger shall have weatherproof gear operator.

B. Single-Flange, 150-psig CWP Rating, Aluminum-Bronze Disc, EPDM Seat, Ferrous-Alloy Butterfly Valves: Full-lug type with ductile-iron body, one- or two-piece Type 416 stainless-steel stem, bronze bushing, aluminum-bronze disc, and phenolic-backed EPDM seat (liner) attached to the body.

1. Cooper Cameron Corp.; Cooper Cameron Valves Div.
2. DeZURIK; SPX Corporation
3. Kitz Model #6123EG
4. NIBCO Model LD-1000-5

C. Single-Flange, 200-psig CWP Rating, Aluminum-Bronze Disc, EPDM Seat, Ferrous-Alloy Butterfly Valves: Full-lug type with ductile-iron body, one- or two-piece, Type 410 or 416 stainless-steel stem, copper bushing, fasteners and pins shall not be used to attach stem, to disc, no pins or fasteners in waterway, aluminum-bronze disc, and molded-in EPDM seat (liner).

1. Cooper Cameron Corp.; Cooper Cameron Valves Div.
2. DeZURIK; SPX Corporation
3. Kitz Model #6123EL or #6123EG
4. NIBCO Model LD-2000-3/5

D. Grooved-End, Ferrous-Alloy Butterfly Valves with EPDM-Encapsulated Ductile-Iron Disc: Ductile-iron with grooved or shouldered ends, polyamide coating inside and outside, two-piece Type 416 stainless-steel stem, PTFE bronze sintered on steel bushing, fasteners and pins shall not be used to attach stem to disc, no pins or fasteners in waterway, and 300-psig CWP Rating for Valves NPS 2 through NPS 8, 200 psig CWP Rating for Valves NPS 10 through NPS 12.

1. Anvil International, Inc.
2. Grinnell Mechanical Products.
3. NIBCO Model GD-4765-3/5
4. Victaulic Co. of America.

2.5 BRONZE CHECK VALVES

A. Bronze Check Valves, General: MSS SP-80.

B. Class 125, Bronze, Lift Check Valves with TFE Disc: ASTM B-584 bronze body and integral seat with soldered or threaded end connections, and having 250-psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. Kitz Model #26 or #36
3. NIBCO Model S-480-Y or T-480-Y
4. Powell, Wm. Co.

C. Class 125, Bronze, Swing Check Valves with TFE Disc: ASTM B-62 bronze body and seat with TFE disc in bronze seat holder, Y-pattern design, soldered or threaded end connections, and having 200 psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. Kitz Model #23T or #22T
3. NIBCO Model S-413-Y or T-413-Y
4. Powell, Wm. Co.

D. Class 150, Bronze, Swing Check Valves with TFE Disc: ASTM B-62 bronze body and seat with TFE disc in bronze seat holder, Y-pattern design, soldered or threaded end connections, and having 300 psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. Kitz #30T or #29T
3. NIBCO Model S-433-Y or T-433-Y
4. Powell, Wm. Co.

E. Class 300, Bronze, Swing Check Valves with Bronze Disc: ASTM B-61 bronze body and seat with regrinding-type bronze disc, Y-pattern design, threaded end connections, and having 600 psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. Kitz Model #19
3. NIBCO Model T-473-B
4. Powell, Wm. Co.

2.6 IRON SWING CHECK VALVES

A. Iron Swing Check Valves, General: MSS SP-71.

B. Class 125, Gray-Iron, Standard Swing Check Valves: ASTM A-126, Class B cast-iron body and bolted bonnet with flanged end connections; non-asbestos synthetic-fiber gaskets; bronze disc and seat; and having 200 psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. Kitz Model #78
3. NIBCO Model F-918-B
4. Powell, Wm. Co.

C. Class 250, Gray-Iron, Swing Check Valves: ASTM A-126, Class B cast-iron body and bolted bonnet with flanged end connections; non-asbestos synthetic-fiber gaskets; and bronze disc and seat; and having 500 psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. NIBCO Model F-968-B
3. Powell, Wm. Co.

D. Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends; nonasbestos, synthetic-fiber gaskets; rubber seats; and having 250-psig CWP Rating.

1. Anvil International, Inc.
2. Grinnell Mechanical Products
3. NIBCO Model G-917-W
4. Victaulic Co. of America

2.7 BRONZE GLOBE VALVES

A. Bronze Globe Valves, General: MSS SP-80, with malleable-iron handwheel.

B. Class 150, TFE Disc, Bronze Globe Valves: ASTM B-62 bronze body, bonnet, and seat, TFE disc, copper-silicone bronze stem, union-ring bonnet, soldered or threaded end connections; and having 300 psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. Kitz Model #10 or #9
3. NIBCO Model S-235-Y or T-235-Y
4. Powell, Wm. Co.

C. Class 300, Stainless-Steel Disc, Bronze Globe Valves: ASTM B-61 bronze body and bonnet, stainless-steel disc and seat, copper-silicone bronze stem, union-ring bonnet, threaded end connections; and having 600 psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. Kitz Model #17S
3. NIBCO Model T-276-AP
4. Powell, Wm. Co.

2.8 CAST-IRON GLOBE VALVES

A. Cast-Iron Globe Valves, General: MSS SP-85 with bolted bonnet, flanged end connections, and non-asbestos packing and gasket.

B. Class 125, Metal Seat, Cast-Iron Globe Valves: ASTM A-126, Class B cast-iron body and bonnet with bronze trim and having 200 psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. Kitz Model #76
3. NIBCO Model F-718-B
4. Powell, Wm. Co.

C. Class 250, Metal Seat, Cast-Iron Globe Valves: ASTM A-126, Class B cast-iron body and bonnet with bronze trim and having 500 psig CWP rating.

1. Crane Co.; Crane Valve Group; Crane Valves.
2. NIBCO Model F-768-B
3. Powell, Wm. Co.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

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

B. 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.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. 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.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Chilled-Water Piping:

1. Ball Valves, NPS 2 and Smaller: Two -piece, full port, stainless-steel trim, copper alloy.
2. Ball Valves, NPS 2-1/2 and Larger: Class 150, full -port, ferrous alloy.
3. Butterfly Valves, NPS 2 to NPS 12: Single-flange, full lug, 200-psig CWP rating, bronze disc, EPDM liner, ductile iron.
4. Butterfly Valves, NPS 14 : Single-flange, full lug, 150-psig CWP rating, bronze disc, EPDM liner, ductile iron.

5. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2 to NPS 8 300-psig CWP rating, EPDM-encapsulated ductile-iron disc.
6. Grooved-End, Ductile-Iron Butterfly Valves, NPS 10 to NPS 12: 200-psig CWP rating, EPDM- encapsulated ductile-iron disc.
7. Swing Check Valves, NPS 2 and Smaller: Class 150, bronze with TFE disc.
8. Swing Check Valves, NPS 2-1/2 and Larger: Class 125, non-slam type, cast-iron, standard.
9. Grooved-End Swing Check Valves, NPS 2-1/2 and Larger: Grooved-end, ductile-iron, swing check valves.

B. Heating Water Piping:

1. Ball Valves, NPS 2 and Smaller: Two -piece, full port, stainless-steel trim, copper alloy.

2. Ball Valves, NPS 2-1/2 and Larger: Class 150, full -port, ferrous alloy.
3. Butterfly Valves,NPS 2 to NPS 12 Single-flange, full lug, 200-psig CWP rating, bronze disc, EPDM liner, ductile iron.
4. Butterfly Valves, NPS 14 : Single-flange, full lug, 150-psig CWP rating, bronze disc, EPDM liner, ductile iron.
5. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2 to NPS 8: 300-psig CWP rating, EPDM- encapsulated ductile-iron disc.
6. Grooved-End, Ductile-Iron Butterfly Valves, NPS 10 to NPS 12: 200-psig CWP rating, EPDM- encapsulated ductile-iron disc.
7. Swing Check Valves, NPS 2 and Smaller: Class 150, bronze with TFE disc.
8. Swing Check Valves, NPS 2-1/2 and Larger: Class 125, cast iron, standard.
9. Grooved-End Swing Check Valves, NPS 2-1/2 and Larger: Grooved-end, ductile-iron, swing check valves.

## 3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. For shut-off service of hydronic systems, use

1. Up to NPS 2: Ball type.
2. NPS 2-1/2 and greater: Butterfly type.

D. Locate valves for easy access and provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above center of pipe.

F. Install valves in position to allow full stem movement.

G. Provide clamp lock lever handle for all valves, other than plug type, NPS 4 or smaller.

H. Provide hand wheel for all valves, other than plug type, NPS 6 and greater.

I. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

## 3.4 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Common Work Results for HVAC" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 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.

END OF SECTION 230523

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-protection piping.
3. Division 23 Sections "Metal Ducts" and "Nonmetal Ducts" for duct hangers and supports.
4. Division 23 Section "HVAC Insulation – Duct, Equipment, and Piping" for pipe saddles at pipe hangers.

## 1.2 DEFINITIONS

A. MFMA: Metal Framing Manufacturers Association.

B. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

C. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

## 1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

## 1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel", AWS D1.3, "Structural Welding Code--Sheet Steel", AWS D1.4, "Structural Welding Code--Reinforcing Steel", ASME Boiler and Pressure Vessel Code: Section IX as required.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."

C. Pipe hangers and supports shall conform to the recommendations of ASHRAE, ASPE, ANSI, and MSS, unless otherwise indicated.

D. Ensure anchors are acceptable per ICC for use in cracked concrete.

E. Furnish and install hangers and supports that conform to the requirements of the following codes and standards:

1. Metal Framing Manufacturers Association

a. MFMA-4, Metal Framing Standards Publication.
b. MFMA-103, Guidelines for the Use of Metal Framing.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Anvil.
3. Bergen-Power Pipe Supports.
4. B-Line Systems, Inc.; a division of Cooper Industries.
5. Carpenter & Paterson, Inc.
6. Empire Industries, Inc.
7. ERICO/Michigan Hanger Co.
8. Globe Pipe Hanger Products, Inc.
9. Grinnell Corp.
10. GS Metals Corp.
11. National Pipe Hanger Corporation.
12. PHD Manufacturing, Inc.
13. PHS Industries, Inc.
14. Piping Technology & Products, Inc.
15. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type or threaded-anchor-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Solid, threaded steel.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

1. Available Manufacturers:

a. Curb Technologies.
b. Pate.
c. Thy Curb.

1) Models:

a) TEMS-1 for insulated roof decks.
b) TEMS-2 for un-insulated and existing roof decks.
c) TEMS-3 for single-ply roof systems.

d. United Air

2. Equipment supports shall be all welded 18 gauge galvanized steel shell, baseplate and counterflashing with internal bulkhead re-enforcement and wood nailer.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and non-metallic 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 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to proper placement of inserts, anchors and other building structural attachments.

3.2 HANGER AND SUPPORT APPLICATIONS

A. Use only one type hangers and supports, by one manufacturer, for each piping service.

B. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

C. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

D. Use galvanized steel, painted, or cadmium plated components in hangers and supports unless otherwise indicated.

E. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing or provide copper-plated hangers and supports for copper piping systems where hangers are in contact with bare pipe.

F. Use padded hangers for piping that is subject to scratching.

G. Horizontal-Piping Hangers and Supports: Select size of hangers and supports to exactly fit pipe size for bare piping, and around piping insulation with saddle or shield for insulated piping. 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. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
4. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8.
6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
7. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2.
9. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8.
10. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 3.
11. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
13. Pipe Slide and Slide Plate (MSS Type 35): For support of piping where horizontal movement due to expansion and contraction may occur, and where a low coefficient of friction is desired. Support system shall include guided plate mounted on a concrete pedestal or structural steel support.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
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 2 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 20, 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.

H. Vertical-Piping Clamps: Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

I. Hanger-Rod Attachments: Select size of hanger rod attachments to suit hanger rods. 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.

J. Building Attachments: Select size of building attachments to suit hanger rods. 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.

K. 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.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

3.3 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-58 and MSS SP-69 for construction standards and applications. Install hangers, supports, clamps, and attachments as required by the following table to properly support piping from building structure.

| Pipe Size (in) | Max. Hanger Spacing (ft) | Min. Rod Size (in) | Max. Alternate Hanger Spacing (ft) | Min. Alternate Rod Size (in) |
|---|---|---|---|---|
| 1/2 | 6 | 3/8 | -- | -- |
| 3/4 | 6 | 3/8 | -- | -- |
| 1 | 7 | 3/8 | -- | -- |
| 1-1/4 | 8 | 3/8 | -- | -- |
| 1-1/2 | 9 | 3/8 | -- | -- |
| 2 | 10 | 3/8 | -- | -- |
| 2-1/2 | 11 | 1/2 | -- | -- |
| 3 | 12 | 1/2 | 8 | 3/8 |
| 3-1/2 | 13 | 5/8 | 8 | 3/8 |
| 4 | 14 | 5/8 | 8 | 3/8 |
| 5 | 16 | 5/8 | 10 | 1/2 |
| 6 | 17 | 3/4 | 10 | 1/2 |
| 8 | 19 | 7/8 | 10 | 1/2 |
| 10 | 20 | 7/8 | 10 | 1/2 |
| 12 | 20 | 7/8 | 10 | 1/2 |
| 14 | 20 | 1 | 16 | 7/8 |
| 16 | 20 | 1-1/8 | 14 | 7/8 |
| 18 | 20 | 1-1/4 | 10 | 7/8 |
| 20 | 20 | 1-1/4 | 10 | 7/8 |
| 24 | 20 | 1-1/4 | 8 | 7/8 |

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricated from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
3. Neither wire nor perforated metal shall be used to support piping, unless otherwise indicated or approved.
4. Do not support piping from other piping, unless otherwise indicated.

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 mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with Division 23 Section "HVAC Insulation – Duct, Equipment, and Piping" and the following:

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 according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier.

   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.
   b. Shield Dimensions for Pipe: Not less than the following:

      1) Pipes NPS 8 and Larger: Include wood inserts.
      2) Insert Material: Length at least as long as protective shield.

   c. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.4 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.5 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports, as required, unless otherwise indicated.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.6 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 inch.

3.7 PAINTING

A. Refer to Division 09 painting Sections.

B. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

C. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Delegated Design requirements for system design.
2. Requirements for Manufacturer Seismic Certification.
3. Requirements for Manufacturer Special Seismic Certification.
4. Isolation pads.
5. Elastomeric hangers.
6. Spring isolators
7. Restrained vibration isolation roof-curb rails.
8. Seismic snubbers.
9. Restraining braces and cables.

B. Related Sections:

1. Division 23 Section "Common Work Results" for description of concrete bases used as vibration isolation.
2. Division 23 Section "Hangers and Supports for HVAC Piping and Equipment" for installation locations of pipe saddles at pipe hangers.

## 1.2 DEFINITIONS

A. IBC: International Building Code.

B. Seismic Certification: Seismic certification refers to a manufacturer's certification for architectural, mechanical, and electrical components, supports, and attachments pursuant to ASCE/SEI 7-05 Section 13.2.1.2.

C. Seismic Qualification: Same as Special Seismic Certification

D. Special Seismic Certification: Seismic certification of mechanical and electrical equipment based on ASCE/SEI 7-05 Section 13.2.2. Special Seismic Certification is required for active mechanical and electrical equipment that must remain operable following the design earthquake.

## 1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for vibration and seismic controls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Do not use more than one pre-approved seismic-force resistance system on any single run of pipe, duct or conduit. Mixing of multiple pre-approved systems is not acceptable.

B. Seismic-Restraint Loading: In preparation of Delegated Design, utilize seismic forces as described in ASCE 7-02 "Minimum Design Loads for Buildings and Other Structures" as published by the American Society of Civil Engineers, unless requirements in this Section are more stringent.

1. Site Class as Defined in the IBC: _.
2. Assigned Seismic Design Category as Defined in the IBC: D. (Bracing of non-structural elements is required.)

    a. Component Importance Factor: 1.5.
    b. Assign component factors based on ASCE-7 Table 13.6-1 for the following:

        1) Component Response Modification Factor.
        2) Component Amplification Factor.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second):

    a. $S_S$ = 0.331g.
    b. $S_{DS}$ = 0.339g.

4. Design Spectral Response Acceleration at 1-Second Period:

    a. $S_1$ = 0.108g.
    b. $S_{D1}$ = 0.171g.

C. Submittal Review Conference: At time of Delegated Design Shop Drawing submission, schedule a submittal review conference with the Architect and Structural Engineer-of-Record for the project. The purpose of this conference is to review attachment locations and insure supplementary framing that is needed to resist the loads, maintain stability or to meet other installation requirements of a pre-approved system have been accounted for in the Structural Engineer-of-Record's design.

1.4 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 23 Section "Common Work Results for HVAC" for products specified under PART 2 – PRODUCTS.

B. General Submittal Requirements:

1. Submittals shall be reviewed by Architect and the Structural Engineer-of-Record prior to submitting them to authorities having jurisdiction.
2. Refer to structural drawings for design criteria.

C. Contractor Statement of Responsibility:

1. Submit a written statement in accordance with IBC Chapter 17.
2. Statement shall be submitted on company letterhead.
3. In instances where trade sub-contractors are responsible for construction and implementation of seismic-force resisting systems, the representatives of these various trade sub-contractors shall sign the Contractor Statement of Responsibility.

D. Product Data: For the following:

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 seismic-restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

E. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
4. Field-fabricated supports.
5. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Division 23 Sections for equipment mounted outdoors.
d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Common Requirements For Qualification Data:

1. Manufacturer Seismic Qualification Certification: Where this Section and other Sections of this Division require products to meet seismic requirements; Submit certification that equipment, devices, accessories, and components will withstand seismic forces defined in this Section. Include the following:

a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

2. Manufacturer Special Seismic Certification: Where this Section and other Sections of this Division require products to meet seismic requirements; Submit certification that equipment, devices, accessories, and components will withstand seismic forces defined in this Section. Include the following:

a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Qualification Data: For professional engineer.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For seismic-force restraint systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Copy of the Delegated Design Shop Drawings, including AHJ approval stamp.
2. Copy of the Delegated Design Submittal, including AHJ approval stamp.

1.7 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC, unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

D. Special Seismic Certification: Mechanical components, supports, and attachments shall be certified pursuant to ASCE/SEI 7-05 Section 13.2.2. Items requiring certification are as follows, but not limited to:

1. Components with hazardous contents, excluding pipes and ducts.

2. Built-up or field assembled equipment.
3. Air handling units.
4. Control panels.

E. Rugged Equipment: Factory assembled, discrete components are considered rugged and deemed to comply with ASCE/SEI 7-05 Section 13.2.6, and do not require Special Seismic Certification, unless otherwise indicated by OSHPD. Items considered exempt are as follows:

1. Equipment and components weighing not more than 20 lbs. supported directly on structures (and not mounted on other equipment or components) with supports and attachments in accordance with Chapter 13, ASCE/SEI 7-05, as modified by Section 1614A, 2007 CBC.

F. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vibration Isolation and Control

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. ISAT
4. Kinetics Noise Control.
5. Korfund Company.
6. Mason Industries.
7. Vibro-Acoustics

B. Seismic Restraint

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.
4. Hyspan.
5. ISAT
6. Kinetics Noise Control.
7. Korfund Company.
8. Mason Industries.
9. TOLCO Incorporated.
10. Unistrut; Tyco International, Ltd.
11. Vibro-Acoustics

2.2 VIBRATION ISOLATORS

A. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a non-slip pattern and galvanized-steel base plates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

B. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Minimum Lateral Stiffness: Kx/Ky = 1.0.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Base plates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to base plate underside. Base plates shall limit floor load to 100 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

C. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled base plate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to base plate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
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. Minimum Lateral Stiffness: Kx/Ky = 1.0.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

D. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

## 2.3 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

A. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic forces.

B. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

C. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch-thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.

b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
d. Minimum Lateral Stiffness: Kx/Ky = 1.0.
e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2. Pads: Oil and water resistant neoprene arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel base plates, and factory cut to sizes that match requirements of supported equipment.

D. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

E. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.4 SEISMIC-RESTRAINT DEVICES

A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

B. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch (6-mm) air gap, and minimum 1/4-inch- (6-mm-) thick resilient cushion.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized or ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener:

1. Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
2. Reinforcing steel angle clamped to hanger rod.

F. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

2.5 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

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 APPLICATIONS

A. Suspended Equipment:

B. Base: Roof Curbs or Rails

1. Equipment:

a. Factory Fabricated AHUs without internal isolation.

2. Isolator:

a. Pad integral with curb.
b. Restrained, open-spring type with 1" deflection.

C. Base: 4" Housekeeping Pad

1. Equipment:

   a. Floor mounted Fan Systems.

      1) Fans?

2. Isolator: Restrained, open spring type with 2" deflection.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

C. Install seismic isolators and restraints as required by delegate design calculations.

D. Install hanger rod stiffeners to prevent buckling of hanger rods due to seismic forces.

E. Install spring isolators for the closest three hangers for all piping attached to rotating equipment.

F. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

G. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

H. Install cables so they do not bend across edges of adjacent equipment or building structure.

I. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

J. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

K. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

L. Strength of Support and Seismic-Restraint Assemblies: Select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

M. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

N. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

## 3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.

## 3.5 IDENTIFICATION

A. Install brass identification tags at all seismic brace locations. Tags to include the following information:

1. Unique keyed identification number that corresponds to nomenclature used to mark location on shop drawings and calculations.
2. Specific G-force the system at that location is designed to resist.
3. Maximum brace reaction to the structure.
4. For Individually suspended items: Maximum conduit size.
5. For Trapeze or Multiple pipe hangers: Maximum pounds-per-lineal-foot.
6. For Suspended Equipment: Maximum weight of equipment.

## 3.6 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. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

F. Prepare a report, certified by testing agency, that identifies unit components and devices checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

3.7 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 230548

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.
4. Valve tags.

## 1.2 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.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

## 1.3 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, laminated phenolic with a black surface and white substrate for mechanical engraving, 1/16 inch minimum thickness, beveled edges, 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: 1/2 inch. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number as directed by owner. Secondary lettering shall indicate date of installation.

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.

D. Punched plastic tape for labels is not acceptable.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction. Labels shall conform to ANSI A13.1 and the following table:

| **Outside Diameter of Pipe or of Covering** | **Height of Letters** |
|---|---|
| ¾" to 1-1/4" | ½" |
| 1-1/2" to 2" | ¾" |
| 2-1/2" to 6" | 1-1/4" |

B. Available Manufacturers: Seton, Brady, or Westline.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover or cover full circumference of pipe.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, and an arrow indicating flow direction. For steam systems, also include line pressure on label.

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.

2.3 DUCT LABELS

A. Material and Thickness: Multicolor, plastic labels having adhesive for attachment.

B. Service:

1. Non-hazardous

a. Supply
b. Return
c. Outside air
d. Relief
e. General Exhaust

2. Hazardous

a. Isolation Exhaust

C. Letter Color:

1. Non-hazardous Service: Black
2. Hazardous Service: Black

D. Background Color:

1. Non-hazardous Service: White
2. Hazardous Service: Orange

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content.

G. Minimum Letter Size: 2-1/2 inch for name of service.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with minimum 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 chain and S-hook or beaded chain.

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 FIRE DAMPERS AND SMOKE DAMPERS

A. Provide identification for all fire damper or smoke damper access openings.

B. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, acrylic enamel red unless otherwise indicated. Paint may be in pressurized spray-can form.

3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

C. Labels

1. A. Material and Thickness: Multilayer, multicolor, laminated phenolic with a red surface and white substrate for mechanical engraving, 1/16 inch (1.6 mm) minimum thickness, beveled edges, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Red.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1 inch (25.4 mm) for name of units. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

D. Fire Damper and Smoke Damper Stencil and Labels Contents

1. "FIRE DAMPER" or "SMOKE DAMPER" as appropriate for each device.

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 using fasteners or adhesives.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding:

1. Painting of piping is specified in Division 09 Section "High-Performance Coatings."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; accessible maintenance spaces such as shafts; 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 20 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
7. In no case shall a line enter or leave a room without being identified.
8. Secure identification markers to piping by firmly pressing markers in place, following removal of protective covering. Additionally secure by banding ends of markers in place using 1/2 inch wide aluminum bands of the type normally used to secure insulation in place.

3.4 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on the outermost surface of an installed air ducts system.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems except:

1. Check valves
2. Valves within factory-fabricated equipment.
3. Shutoff valves directly adjacent to equipment
4. Faucets
5. Convenience and lawn-watering hose connections
6. HVAC terminal devices

B. Emergency shut-off valves: Provide permanent equipment label with minimum 1" high lettering. These valves include valves 2" and larger for the following services:

1. Domestic cold water.
2. Domestic hot water.
3. Chilled water.
4. Heating water.

C. Mark ceiling grid with colored markerin style and material as required by Owner indicating valve locations above ceiling.

D. List tagged valves in a valve schedule and provide to Owner with floor plans indicating location.

3.6 FIRE DAMPER AND SMOKE DAMPER LABEL INSTALLATION

A. Stencil the words "FIRE DAMPER" or "SMOKE DAMPER" on access doors that are in sheet metal ducts. Ensure overspray of stencil medium is cleaned, removed, or covered from adjacent piping, walls, and as otherwise indicated.

B. Install tags on access doors that are in walls or ceilings where such doors conceal fire damper access plates, or on the T-bars of removable ceilings immediately below the location of fire damper access openings above.

END OF SECTION 230553

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:

   a. Constant-volume air systems.
   b. Variable-air-volume systems.

2. Hydronic Piping Systems:

   a. Constant-flow systems.
   b. Variable-flow systems.

3. HVAC equipment quantitative-performance settings.
4. Space pressurization testing and adjusting.
5. Verifying that automatic control devices are functioning properly.
6. Reporting results of activities and procedures specified in this Section.

## 1.2 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. NC: Noise criteria.

F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

G. RC: Room criteria.

H. Report Forms: Test data sheets for recording test data in logical order.

I. Smoke-Control System: An engineered system that uses fans to produce airflow and pressure differences across barriers to limit smoke movement.

J. Smoke-Control Zone: A space within a building that is enclosed by smoke barriers and is a part of a zoned smoke-control system.

K. Stair Pressurization System: A type of smoke-control system that is intended to positively pressurize stair towers with outdoor air by using fans to keep smoke from contaminating the stair towers during an alarm condition.

L. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

M. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

N. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

O. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

P. TAB: Testing, adjusting, and balancing.

Q. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

R. Test: A procedure to determine quantitative performance of systems or equipment.

S. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days from Contractor's Notice to Proceed, submit 6 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days from Contractor's Notice to Proceed, submit copies of the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit 2 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review based on system readiness reports and pre-functional check lists.

F. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

G. ample Report Forms: Submit two sets of sample TAB report forms.

H. 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.

1.4 QUALITY ASSURANCE

A. The TAB firm shall be organized to provide independent professional testing and balancing services. The firm shall have a minimum of one (1) Professional Engineer licensed in the project's state, in good standing with the board and have a current registration.

B. All personnel used on the job site shall be either TAB engineers or TAB technicians, who shall have been permanent, full-time employees of the Tab firm for a minimum of six (6) months prior to working on the project.

C. Upon request, the TAB Firm shall submit the following to the Architect/Engineer and/or Owner for approval prior to commencing services:

1. Name and biographical data of the Professional Engineer and all personnel to be assigned to this project.
2. Proof of company operation for minimum of five (5) years.

D. TAB Firm Qualifications: Engage a TAB firm certified by AABC.

E. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: As a minimum, include the following:

a. Submittal distribution requirements.
b. The Contract Documents examination report.
c. TAB plan.
d. Work schedule and Project-site access requirements.
e. Coordination and cooperation of trades and subcontractors.
f. Coordination of documentation and communication flow.
g. Coordinate submission of FMS sequence and schematics for review by TAB firm.

F. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

G. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."

H. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."

I. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.5 PROJECT CONDITIONS

A. Owner Occupancy: Owner may occupy the completed areas of the site and existing building prior to substantial completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.6 COORDINATION

A. Notice: Provide minimum seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

C. The Contractor shall start up and test all materials and equipment which normally require testing. All piping, etc., shall be tested to meet code requirements or the specification requirements, whichever is the more stringent. All equipment shall operate a sufficient length of time at the Contractor's expense to prove to the Architect/Engineer and/or Owner that the equipment is free from mechanical defects, runs smoothly and quietly and performs satisfactorily to meet the requirements set forth in the mechanical plans and specifications.

D. In order that all HVAC systems can be properly tested, adjusted and balanced, the Contractor shall operate the HVAC systems at his expense for the length of time necessary to properly verify their completion and readiness for TAB, and shall further operate and pay all costs of operation during the TAB period. Operating expenses to be paid for by the Contractor will include, but not necessarily be limited to, the following:

1. Utility costs; electrical, water, gas, etc.
2. Personnel costs to start, operate and stop all HVAC equipment.
3. All start-up labor and material costs.
4. All maintenance costs.
5. Water treatment.

E. The plans and specifications have indicated valves, dampers and miscellaneous adjustment devices for the purpose of testing and balancing the HVAC systems to obtain optimum operating conditions. The Contractor shall install these devices in a manner that will leave them accessible and readily adjustable. Should any such device not be readily accessible, the Contractor shall provide access as required.

F. The Contractor shall provide and coordinate services to repair or replace any and all deficient items or conditions found before and during the TAB period.

G. As a part of this Project Contract, the Contractor shall make any changes in the sheaves, belts, motors, dampers and valves or the addition of dampers and/or valves as required to correctly balance the HVAC systems as required at no additional cost.

H. Provide sufficient time in Project Contract completion schedule to permit the completion of TAB services prior to Owner occupancy of the Project.

I. The Contractor shall furnish without charge to the TAB Firm:

1. One set of mechanical specifications and all addenda.
2. All pertinent change orders.
3. Complete set of mechanical plans with latest revisions.
4. "As-installed" drawings.
5. Approved control diagrams and submittals.
6. Approved manufacturer's submittals for all HVAC equipment.

1.7 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements.

1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
3. Based on examination of the Contract Documents, to recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."

D. 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.

E. Examine equipment performance data including fan and pump curves. 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. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

M. Examine system pumps to ensure absence of entrained air in the suction piping.

N. Examine equipment for installation and for properly operating safety interlocks and controls.

O. Examine control system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

P. 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. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Prepare a TAB plan that includes strategies and step-by-step procedures.

C. The Contractor shall complete system readiness checks, prepare system readiness reports, and prefunctional tests including the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

## 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. TAB firm shall coordinate with Contractor to gather all required system points and data without voiding manufacturers' warranties. Facility personnel and factory-authorized service representatives may also be required.

B. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" and this Section.

C. Cut insulation, penetrate pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

D. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

E. 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. Provide a marked-up set of mechanical plans or "as-built" duct layouts of systems that includes numbering of each HVAC device that corresponds to the respective item in the TAB report.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

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. Check for proper sealing of air duct system.

3.5 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:

1. Check liquid level in expansion tank.
2. Check highest vent for adequate pressure.
3. Check flow-control valves for proper position.
4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
5. Verify that motor starters are equipped with properly sized thermal protection.
6. Check that air has been purged from the system.

3.6 GENERAL PROCEDURES FOR DOMESTIC HOT WATER SYSTEMS

A. Balance domestic hot water recirculation, to ensure proper flow through all mains and branches. Tune system until hot water is delivered to the most remote fixture within the allowable time as required by the AHJ.

3.7 PROCEDURES FOR SPACE PRESSURIZATION MEASUREMENTS AND ADJUSTMENTS

A. Pressure testing shall be limited to the following room types:

1. Isolation Rooms.

B. Before testing for space pressurization, observe the space to verify the integrity of the space boundaries. Verify that windows and doors are closed and applicable safing, gaskets, and sealants are installed. Report deficiencies and postpone testing until after the reported deficiencies are corrected.

C. Measure, adjust, and record the pressurization of each room, each zone, and each building by adjusting the supply, return, and exhaust airflows to achieve the indicated conditions.

D. Measure space pressure differential where pressure is used as the design criteria, and measure airflow differential where differential airflow is used as the design criteria for space pressurization.

1. For pressure measurements, measure and record the pressure difference between the intended spaces at the door with all doors in the space closed. Record the high-pressure side, low-pressure side, and pressure difference between each adjacent space.
2. For applications with cascading levels of space pressurization, begin in the most critical space and work to the least critical space.
3. Test room pressurization first, then zones, and finish with building pressurization.

E. To achieve indicated pressurization, set the supply airflow to the indicated conditions and adjust the exhaust and return airflow to achieve the indicated pressure or airflow difference.

F. For spaces with pressurization being monitored and controlled automatically, observe and adjust the controls to achieve the desired set point.

1. Compare the values of the measurements taken to the measured values of the control system instruments and report findings.
2. Check the repeatability of the controls by successive tests designed to temporarily alter the ability to achieve space pressurization. Test overpressurization and underpressurization, and observe and report on the system's ability to revert to the set point.
3. For spaces served by variable-air-volume supply and exhaust systems, measure space pressurization at indicated airflow and minimum airflow conditions.

G. In spaces that employ multiple modes of operation, such as normal mode and emergency mode or occupied mode and unoccupied mode, measure, adjust, and record data for each operating mode.

H. Record indicated conditions and corresponding initial and final measurements. Report deficiencies.

## 3.8 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.

5. Bearings and other parts are properly lubricated. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
4. Air balance each air outlet.

3.9 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures for systems with pneumatic components and device positions and correlate with airflow and water flow measurements.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. For pneumatic systems, check main control supply-air pressure and observe compressor and dryer operations.

J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.10 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans:

a. Up to 5000 cfm: 0 to plus 10 percent.
b. Larger than 5000 cfm: 0 to plus 5 percent.

2. Air Devices

a. Exhaust: 0 to -10 percent.
b. Return: +/-5 percent.

c. Supply: 0 to +10 percent.

3. Hydronic Flow Rates

a. Pumps: 0 to +10 percent.
b. Equipment: 0 to +5 percent.

3.11 REPORTING

A. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
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 firm 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, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.

E. Provide a marked-up set of mechanical plans or "as-built" layouts of systems that include numbering of each HVAC device that corresponds to the respective item in the TAB report.

1. Quantities of outside, 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.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

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. Sheave dimensions, center-to-center, and amount of adjustments in inches.
j. Number of belts, make, and size.
k. Number of filters, type, and size.

2. Motor Data:

a. 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. Sheave dimensions, center-to-center, and amount of adjustments in inches.

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. Filter static-pressure differential in inches wg.
f. Filter condition.
g. Preheat coil static-pressure differential in inches wg.
h. Cooling coil static-pressure differential in inches wg.
i. Heating coil static-pressure differential in inches wg.
j. Outside airflow in cfm.
k. Return airflow in cfm.
l. Relief airflow in cfm.
m. Outside-air damper position.

n. Return-air damper position.
o. Relief-air damper position.
p. Fan drive settings including VFD settings and percentage of maximum pitch diameter.
q. Settings for supply-air static-pressure controller.

G. 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. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outside-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.

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. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Motor Data:

a. 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. Sheave dimensions, center-to-center, and amount of adjustments in inches.
g. Number of belts, make, and size.

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 airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow 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. Test apparatus used.
d. Area served.
e. Air-terminal-device make.
f. Air-terminal-device number from system diagram.
g. Air-terminal-device type and model number.
h. Air-terminal-device size.
i. Air-terminal-device effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.

f. Final velocity in fpm.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

L. Pump Test Reports:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model and serial numbers.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.

k. Amperage for each phase.
l. Impeller size.

M. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.13 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Measure sound levels at two locations.
e. Measure space pressure of at least 10 percent of locations.
f. Verify that balancing devices are marked with final balance position.
g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.

7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.14 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing 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 testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 230593

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. Section Includes:

1. Insulation Materials
a. Calcium silicate.
b. Fiberglass.
c. Flexible elastomeric.
2. Factory-applied jackets.
3. Field-applied cloths.
4. Field-applied jackets.
5. Adhesives.
6. Mastics.
7. Lagging adhesives.
8. Sealants.
9. Tapes.
10. Securements.

B. Related Sections:
1. Division 22 Section "Plumbing Insulation."
2. Division 23 Section "Hangers and Supports for HVAC Piping and Equipment" for installation locations of pipe saddles at pipe hangers.

## 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Calculations: For insulation submitted outside of the conductivity range per the "Minimum Pipe Insulation Thickness" Table for the application listed, submit thickness calculations.

C. Shop Drawings:
1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application of field-applied jackets.
6. Detail application at linkages of control devices.
7. Detail field application for each equipment type.

## 1.3 INFORMATIONAL SUBMITTALS

A. 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.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the United States Department of Labor, Employment and Training Registered Apprenticeship Program.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 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 size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 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 MANUFACTURERS

A. Fiberglass
1. Johns-Manville.
2. K-Flex.
3. Knauf Fiberglass.
4. Manson (Certain Teed).
5. Owens-Corning.
6. Pittsburg-Corning.

2.2 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Fiberglass
1. Flexible glass fiber; ASTM C553 and ASTM C1290; commercial grade; 'k' value of 0.25 at 75 degrees F; 1.5 lb/cu ft minimum density; 0.002 inch foil scrim kraft facing for air ducts.
2. Rigid glass fiber; ASTM C612, Class 1; 'k' value of 0.23 at 75 degrees F; 3.0 lb/cu ft minimum density.

E. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials with a built-in vapor barrier. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig-minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 360 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 ADHESIVES

A. Products: Subject to compliance with requirements, insulation manufacturer shall provide insulation adhesive and jacket manufacturer shall provide jacket adhesive.

B. 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.

C. Cellular-Glass and Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

2.5 MASTICS

A. Products: Subject to compliance with requirements, insulation manufacturer shall provide mastics.

B. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

C. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 360 deg F.
3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
4. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 200 deg F.
3. Solids Content: 63 percent by volume and 73 percent by weight.
4. Color: White.

2.6 LAGGING ADHESIVES

A. Products: Subject to compliance with requirements, insulation manufacturer shall provide lagging adhesives

B. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
2. Service Temperature Range: Minus 50 to plus 360 deg F.
3. Color: White.

2.7 SEALANTS

A. Products: Subject to compliance with requirements, insulation manufacturer shall provide sealants

B. Joint Sealants for Cellular-Glass, and Phenolic Products:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

C. 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.

D. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.8 INSULATING CEMENT

A. ASTM C 195; hydraulic setting mineral fiber thermal insulating cement with dry density of no more than 38 lb/ft3 thermal conductivity of 0.96 at 400°F mean temperature, and service temperature to 1200°F.

B. Acceptable manufacturers: RAMCO or approved equal.

2.9 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

2.10 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..

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. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.11 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, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; Metal Jacketing Systems.
b. PABCO Metals Corporation; Surefit.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

    a. Factory cut and rolled to size.
    b. Finish and thickness are indicated in field-applied jacket schedules.
    c. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.12 TAPES

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Avery Dennison Corporation, Specialty Tapes Division.
2. Compac Corp.
3. Ideal Tape Co., Inc., an American Biltrite Company.
4. Venture Tape.
5. Dow Chemical Company (The).

B. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

    1. Width: 3 inches.
    2. Thickness: 11.5 mils.
    3. Adhesion: 90 ounces force/inch in width.
    4. Elongation: 2 percent.
    5. Tensile Strength: 40 lbf/inch in width.
    6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

C. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

    1. Width: 3 inches.
    2. Thickness: 6.5 mils.
    3. Adhesion: 90 ounces force/inch in width.
    4. Elongation: 2 percent.
    5. Tensile Strength: 40 lbf/inch in width.
    6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

    1. Width: 2 inches.
    2. Thickness: 3.7 mils.
    3. Adhesion: 100 ounces force/inch in width.
    4. Elongation: 5 percent.

5. Tensile Strength: 34 lbf/inch in width.

2.13 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.

B. Insulation Pins and Hangers:

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. AGM Industries, Inc.
   b. GEMCO.
   c. Midwest Fasteners, Inc.
   d. Nelson Stud Welding.

2. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, minimum 0.106-inch-diameter shank, length to suit depth of insulation indicated.
3. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, minimum 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
4. 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: Match ductwork material, 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.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: Match ductwork material, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

c. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers 0.016-inch-thick, Match pin material, 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.

2.14 PIPE INSULATION HANGER SHIELDS

A. Where hangers are placed outside the jackets of pipe insulation, provide shields or equivalent by Elcen Metal Products Company.

B. Insulation and shields shall consist of a 360 degree insert of high-density, 100 psi, waterproof calcium silicate, encased in a 360 degree galvanized sheet steel shield. Insert shall be same thickness as adjoining pipe insulation, and shall extend 1-inch beyond sheet metal shield in each direction. Shield lengths and minimum sheet metal gauges shall be as directed below:

| PIPE SIZE | SHIELD LENGTH | MINIMUM GAUGE |
|---|---|---|
| 1/2" to 8" | 12" | 16 |

C. Insulation and shields for Phenolic type insulation shall consist of a 360 degree insert of high-density (minimum 5 lbs/cu.ft.) phenolic insulation by the same manufacturer, encased in a 360 degree galvanized sheet steel shield. Insert shall be same thickness as adjoining pipe insulation, and shall extend 1-inch beyond sheet metal shield in each direction. Shield length and gauge per above table.

D. Shields shall be Model A1000 – A9000, except for pipe roller applications and where pipe hanger spacing exceeds 10 feet, then provide Model CSX-CW.

E. At the Contractor's option, shop-fabricated galvanized metal shields may be provided based on approved shop drawings. Length and gauge of sheet metal shall be as specified above.

2.15 PREMANUFACTURED COVERS

A. Preformed manufactured PVC fitting covers with rigid one piece (half-shell) preformed rigid insulation.

PART 3 - EXECUTION

3.1 GENERAL

A. Materials shall be applied by a qualified insulation applicator/workman skilled in this trade. Insulation shall be installed in accordance with the manufacturers written instructions and in accordance with recognized industry standards. Mechanical fasteners shall be used whenever possible to assure permanent construction. Unsightly work shall be cause for rejection.

B. Prior to installation of any insulation materials to ferrous piping systems, the piping surfaces shall be thoroughly cleaned of all mill scale, grease and dirt and passed pressure testing.

C. Non-compressible insulation material shall be installed at hanger supports on cold piping to prevent damage to insulation and vapor barrier. All wet duct and pipe insulation shall be replaced.

D. Insulation of cold surfaces shall be vapor-sealed to prevent condensation.

E. Minimum thickness of insulation shall be as scheduled unless alternate thicknesses can be shown to meet energy performance and approved by the Engineer.

F. Where piping system insulation is specified, cover valves, strainers, unions, flanges, and fittings with pre-manufactured valve and fitting covers.

G. Install pipe insulation hanger shields.

H. Extend piping insulation without interruption through walls, floors and similar piping penetrations, there shall be no exceptions.

I. Duct insulation shall terminate at fire/smoke damper sleeves. A separate strip of insulation shall be provided around the sleeve and sealed at the wall.

J. Miscellaneous Applications

1. Refrigerant suction lines within air cooled condensing units, heat pumps and chillers.

K. Unless indicated otherwise, insulate pipe and equipment that operates:

1. 10 degrees or lower than ambient space temperature.
2. 10 degrees of higher than ambient space temperature.

L. All steam valves and regulators at and below an elevation of 7' - 0" A.F.F. shall be insulated with removable asbestos free insulation jackets with Velcro fasteners to allow easy installation and removal.

3.2 APPLICATION TYPES

A. Equipment

E1: Cut insulation to fit contour of equipment, and secure by means of bands, stick-clips, weld-pins and lugs or adhesives as required for each individual piece of equipment. Provide vapor barrier and finish as required for each specific application. Provide new cold surfaces of pumps with accessible boxes that easily separate coincidental with parting line of evaporator heads and pump casings. Resulting insulation joints shall be covered with a self-sealing, vapor-barrier tape. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic.

B. Piping

P1: Butt insulation together and securely tape. Install factory-furnished laps at the butt joints. Neatly bevel and finish insulation where it terminates. Seal with double tape self-sealing adhesives.

P2: Butt insulation together and securely tape. Install factory-furnished laps at the butt joints. Neatly bevel and finish insulation where it terminates. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic.

C. Ductwork

D1: Apply fiberglass board insulation to ducts with mechanical fasteners such as stick-clips or weld-pins (with tape and mastic) spaced as required to install full pieces of board insulation. Space on 12" centers (maximum) on the bottom of each duct and plenum. Cover joints and seams in vapor barrier facings with 3" wide matching tape, or with vapor-barrier mastic reinforced with 3" glass mesh reinforcement. Provide an additional layer of insulation board where duct-standing seams exceed the insulation thickness. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic.

D2: Wrap flexible fiberglass insulation around ducts and secure. Additionally, ducts 24 inches wide and larger shall secure insulation with stick clips on 18" centers. Lap insulation a minimum of four (4) inches and seal with an approved vapor barrier mastic. Reinforce lap with a three (3) inch wide band of either glass mesh reinforcement or foil/vapor-barrier tape. Seal raw glass to duct where insulation terminates. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic.

3.3 INSULATION SCHEDULE KEYS

**Insulation Types Key**

| | Type | Maximum K Factor @ 75°F | Temp. Limit °F | Density Lb. Per Cubic Foot | Federal Spec. Compliance |
|---|---|---|---|---|---|
| 1. | Calcium Silicate | 0.38 | 1200 | 14 | HH-I-523C |
| 2. | Fiberglass (Rigid) | 0.23 | 450 | 3 | ASTM C 547 Type 1 |
| 3. | Fiberglass Flexible Duct Wrap | 0.25 | 250 | 1.5 | |
| 4. | Foamed Glass (Cellular) | 0.36 | 850 | 9 | HH-I-1751/3A |
| 5. | Foamed Plastic (Flexible) | 0.25 | 220 | 5 | HH-I-573 |
| 6. | High Temperature Fiberglass | 0.23 | 850 | 3 | HH-1-558B |
| 7. | Insulating Cement | 0.7 | 1700 | | SS-C-160 |
| 8. | Phenolic | 0.13 | 250 | 2.5 | ASTM C 1126 |
| 9. | Flexible Elastomeric | 0.27 | 220 | | ASTM C 177 or C518 |
| 10. | Polyolefin | 0.25 | 200 | 2 | ASTM C 177 or C518 |

**Finishes Key**

| | |
|---|---|
| F1. | 8-ounce glass cloth |
| F2. | Insulation cement |
| F3. | 0.016 aluminum, plain, up through 12" pipe size; 0.016 aluminum, corrugated, for pipe sizes 14" and larger |
| F4. | 15-mil PVC |
| F5. | Foil/reinforced/kraft jacket (vapor barrier) |
| F6. | 1/4-inch weatherproof mastic with glass mesh reinforcement |
| F7. | 1/16" vapor barrier mastic (0.05 perm rating) with glass mesh reinforcement |
| F8. | White all-service jacket (vapor barrier) with self-sealing lap, or taped joints |
| F9. | Two coats vinyl lacquer type white paint |
| F10. | Canvas jacketing of 6 oz. Minimum, 100% cotton woven fabric with 25/50 flame/smoke rating and equal to Fattal's Thermocanvas Recovery Jacket. |

3.4 DUCT AND PLENUM INSULATION

A. Supply Air Ducts and Plenums in Concealed Locations

1. Minimum R-value: 6.
2. Insulation Materials: Fiberglass Flexible Duct Wrap.
3. Application Type: D2.
4. Indoor Finish: F5.
5. Outdoor Finish: F1 and F2.

B. Relief, Return, Exhaust Ducts, and Plenums, and Air Devices in Concealed Locations Under an Exposed Roof.

1. Minimum R-value: 6.
2. Insulation Materials: Fiberglass Flexible Duct Wrap.
3. Application Type: D2.
4. Indoor Finish: F5.
5. Outdoor Finish: F1 and F2.

3.5 EQUIPMENT INSULATION

A. Equipment above ambient temperature, excluding factory insulated assemblies.

1. Equipment includes, unless otherwise indicated:

a. Hot Water:

1) Pumps.

2. Insulation Materials:

a. Rigid Fiberglass.

3. Application Types:

a. E1.

4. Indoor Finish:

a. F2 and F1.

B. Equipment insulation thicknesses and performance shall be based on Minimum Pipe Insulation Thickness schedule.

3.6 PIPING INSULATION

A. Minimum insulation thicknesses are scheduled below.

B. 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.

C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following unless there is a potential for personnel injury.

1. Drainage piping located in crawl spaces.
2. Underground piping.

D. Fitting and Valve Covers:

1. Fitting covers shall be of preformed PVC for indoor service and metal for outdoor service.
2. Insulation material shall be rigid and of the same or greater material type and thickness, density and conductivity as the adjoining pipe. Blanket inserts will not be allowed.
3. Fittings on fiberglass pipe insulation shall be mitered insulation up to 2″ diameter and molded fittings for 2½″ and larger.

E. Hot Water Indoors, Concealed or Exposed.

1. Insulation Material: Rigid Fiberglass.
2. Application Type: P2.
3. Finish: F8.

F. Chilled Water, Heating Hot Water, Concealed or Exposed.

1. Insulation Material: Cellular Glass, with mitered section fittings only and field applied ASJ.
2. Application Type: P2.
3. Finish: F8 and F3.

| MINIMUM PIPE INSULATION THICKNESS | | | | | | | |
|---|---|---|---|---|---|---|---|
| FLUID TEMP. (°F) | Insulation Conductivity | | Nominal Pipe or Tube Size (in.) | | | | |
| | Conductivity Btu*in./(h*ft□*°F) | Mean Rating Temp. °F | <1 | 1 to <1-½″ | 1-½ to <4 | 4 to <8 | ≥8 |
| **Heating Systems (Steam, Steam Condensate, and Hot Water)** | | | | | | | |
| >350 (Includes HPS) | 0.32-0.34 | 250 | 2.5 | 3.0 | 3.0 | 4.0 | 4.0 |
| 251-350 (Includes HPR, BF) | 0.29-0.32 | 200 | 1.5 | 2.5 | 3.0 | 3.0 | 3.0 |
| 201-250 (Includes LPS, LPR) | 0.23 | 150 | 1.5 | 1.5 | 3.0 | 3.0 | 3.0 |
| 141-200 (Includes HS, HR) | 0.23 | 125 | 1.5 | 1.5 | 2.0 | 2.0 | 2.0 |
| 105-140 | 0.23 | 100 | 1.5 | 1.5 | 2.0 | 2.0 | 2.0 |
| **Cooling Systems (Chilled Water, Brine, and Refrigerant)** | | | | | | | |
| ≥40 | 0.36 | 100 | 1.5 | 1.5 | 1.5 | 2.0 | 2.0 |
| <40 | 0.36 | 100 | 1.5 | 1.5 | 1.5 | 2.0 | 2.0 |

**Notes:**

4. The above table is applicable to insulations in the conductivity ranges stated only. For insulation outside these conductivity ranges, the minimum thickness (T) shall be determined by the following calculation and the calculation submitted for acceptance:
5. $T=r\{(1+t/r)^{K/k} - 1\}$
6. where T = Thickness
7. $r$ = Actual outside radius of pipe (in.)
8. $t$ = Insulation thickness per the above table
9. K = Conductivity of alternate material
10. k = Upper value of the Conductivity Range per the above table

END OF SECTION 230700

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. Intent for controls scope is to provide fully functioning Tridium Niagara controls system for the building expansion and all related new equipment. Existing equipment and systems in the renovated portion of the building are to be migrated to this new control system, particularly replacement dual duct boxes and control points within the occupied spaces. Air handling systems in the penthouse and boiler systems are to remain on existing JCI system.

B. 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.

C. Related Sections include the following:

1. Division 23 Section "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.
2. Division 23 Section "Custom Central Station AHUs" for additional requirements.

## 1.2 DEFINITIONS

A. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.

B. BMS: Building Management System also defined as Integrated Automation System constructed using a Niagara Framework.

C. BACnet Specific Definitions:

1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data over and services over a network.
2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
4. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.
5. PICS (Protocol Implementation Conformance Statement): Written document that identifies the particular options specified by BACnet that are implemented in a device.

D. Binary: Two-state signal where a high signal level represents ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.

E. Comm: An abbreviation for Communication.

F. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: Network Controller, Programmable Application Controller, and Application-Specific Controller.

G. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.

H. DDC: Direct digital control.

I. EPO: Emergency power off. An emergency push-button used to de-energize connected power equipment. EPOs are typically installed at room egresses and have a guard to prevent accidental activation.

J. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.

K. HOA: Hand-Off-Auto override control provided at the control source for manipulation of controlled hardware downstream of the controller.

L. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.

M. LAN: Local Area Network.

N. LON Specific Definitions:

1. FTT-10: Echelon Transmitter-Free Topology Transceiver.
2. LonMark: Association comprising suppliers and installers of LonTalk products. Association provides guidelines for implementing LonTalk protocol to ensure interoperability through a standard or consistent implementation.
3. LonTalk: An open standard protocol developed by the Echelon Corporation that uses a "Neuron Chip" for communication. LonTalk is a register trademark of Echelon.
4. LonWorks: Network technology developed by Echelon.
5. Node: Device that communicates using CEA-709.1-C protocol and that is connected to a CEA-709.1-C network.
6. Node Address: The logical address of a node on the network, consisting of a Domain number, Subnet number, and Node number. "Node number" portion of an address is a number assigned to device during installation, is unique within a subnet, and is not a factory-set unique Node ID.
7. Node ID: A unique 48-bit identifier assigned at factory to each CEA-709.1-C device. Sometimes called a "Neuron ID."
8. Program ID: An identifier (number) stored in a device (usually EEPROM) that identifies node manufacturer, functionality of device (application and sequence), transceiver used, and intended device usage.
9. Standard Configuration Property Type (SCPT): Pronounced "skip-it." A standard format type maintained by LonMark International for configuration properties.
10. Standard Network Variable Type (SNVT): Pronounced "snivet." A standard format type maintained by LonMark used to define data information transmitted and received by individual nodes. "SNVT" is used in two ways. It is an acronym for "Standard Network Variable Type" and is often used to indicate a network variable itself (i.e., it can mean "a network variable of a standard network variable type").
11. Subnet: Consists of a logical grouping of up to 127 nodes, where logical grouping is defined by node addressing. Each subnet is assigned a number, which is unique within a Domain. See "Node Address."

12. TP/FT-10: Free Topology Twisted Pair network defined by CEA-709.3 and is most common media type for a CEA-709.1-C control network.
13. TP/XF-1250: High-speed, 1.25-Mbps, twisted-pair, doubly terminated bus network defined by "LonMark Interoperability Guidelines" typically used only to connect multiple TP/FT-10 networks.
14. User-Defined Configuration Property Type (UCPT): Pronounced "U-Keep-It." A Configuration Property format type that is defined by device manufacturer.
15. User-Defined Network Variable Type (UNVT): Network variable format defined by device manufacturer. UNVTs create non-standard communications that other vendors' devices may not correctly interpret and may negatively impact system operation. UNVTs are not allowed.

O. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

P. Modbus TCP/IP: An open protocol for exchange of process data.

Q. MS/TP: Master-slave/token-passing, IEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.

R. MTBF: Mean time between failures.

S. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicate on peer-to-peer network for transmission of global data.

1. JACE: Tridium Niagara N4 LAN/WAN Network controller directly connects to the supervisor.

T. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.

U. Niagara Specific Definitions:

1. Fox Protocol: The Niagara Framework includes a proprietary protocol called Fox which is used for all network communication between stations as well as between Workbench and stations. Fox is a multiplexed peer to peer protocol that sits on top of a TCP connection.
2. Jace: (Java Application Control Engine) – In order to integrate diverse systems, a physical connection to a device's network is required. A JACE is a mechanism/device that provides connectivity to systems (HVAC, electrical…even security in some instances) within a building via the Niagara framework.
3. N4: N4 is the latest Generation of the Niagara Framework.
4. Niagara Framework: Niagara Framework is a universal software infrastructure that allows building controls integrators, to build custom, web-enabled applications for accessing, automating and controlling smart devices real-time via local network or over the Internet. Tridium is built on Niagara AX or N4 which is the framework of choice for all future control projects. ... A typical Tridium device is comprised of several open and proprietary protocols provided on a scalable platform from which building operators can design their automation systems.
5. Supervisor: Short name for Web Supervisor or the Server that hosts the Building Automation System.
6. Tridium is the developer of Niagara Framework.

V. PC: Personal computer.

W. Peer to Peer: Networking architecture that treats all network stations as equal partners.

X. PID: Proportional plus integral plus derivative.

Y. RTD: Resistance temperature detector.

Z. UPS: Uninterruptible power supply.

AA. USB: Universal Serial Bus.

BB. WAN: Wide Area Network.

1.3 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

a. Water Temperature: Plus or minus 0.5 deg F.
b. Water Flow: Plus or minus 3 percent of full scale.
c. Water Pressure: Plus or minus 1 percent of full scale.
d. Space Temperature: Plus or minus 0.5 deg F.
e. Ducted Air Temperature: Plus or minus 0.5 deg F.
f. Outside Air Temperature: Plus or minus 0.5 deg F.
g. Dew Point Temperature: Plus or minus 2 deg F.
h. Temperature Differential: Plus or minus 0.25 deg F.
i. Relative Humidity: Plus or minus 2 percent.
j. Airflow (Pressurized Spaces): Plus or minus 2 percent of full scale.
k. Airflow (Measuring Stations): Plus or minus 3 percent of full scale.
l. Airflow (Terminal): Plus or minus 3 percent of full scale.
m. Air Pressure (Space): Plus or minus 0.005-inch wg.
n. Air Pressure (Ducts): Plus or minus 0.05-inch wg.
o. Carbon Monoxide: Plus or minus 5 percent of reading.
p. Carbon Dioxide: Plus or minus 50 ppm.
q. Electrical: Plus or minus 3 percent of reading.

1.4 ACTION SUBMITTALS

A. Multiple Submissions:

1. If multiple submissions are required to execute work within schedule, first submit a coordinated schedule clearly defining intent of multiple submissions. Include a proposed date of each submission with a detailed description of submittal content to be included in each submission.
2. Clearly identify each submittal requirement indicated and in which submission the information will be provided.
3. Include an updated schedule in each subsequent submission with changes highlighted to easily track the changes made to previous submitted schedule.

B. 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.

1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

C. 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, pumps, coils, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequence of operation.
6. Schedule of dampers including size, leakage, and flow characteristics.
7. Schedule of valves including flow characteristics.

8. DDC System Hardware:

   a. Wiring diagrams for control units with termination numbers.
   b. Schematic diagrams and floor plans for field sensors and control hardware.
   c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.

9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
10. Controlled Systems:

    a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    c. Written description of sequence of operation including schematic diagram.
    d. Points list.

D. Data Communications Protocol Certificates: Certify that each proposed DDC system component, including workstations, diagnostic units, unitary and assembled controllers, and all informational and signal processes, are BACnet compatible and compliant with ASHRAE 135.

E. 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.
5. Software license required by and installed for DDC workstations and control systems.

F. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For DDC system to include in emergency, operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
c. As-built versions of submittal Product Data.
d. Names, addresses, e-mail addresses and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control and changing set points and variables.
f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
g. Engineering, installation, and maintenance manuals that explain how to:

1) Design and install new points, panels, and other hardware.
2) Perform preventive maintenance and calibration.
3) Debug hardware problems.
4) Repair or replace hardware.

h. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
i. Backup copy of graphic files, programs, and database on electronic media such as DVDs.

j. List of recommended spare parts with part numbers and suppliers.
k. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
l. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
m. Licenses, guarantees, and warranty documents.
n. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
o. Owner training materials.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Automatic 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.

1.8 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.

1.9 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 28 Section "Access Control" to achieve compatibility with equipment that interfaces with that system.

C. Coordinate equipment with Division 26 Section "Network Lighting Controls" to achieve compatibility with equipment that interfaces with that system.

D. Coordinate equipment with Division 28 Section "Fire Detection and Alarm" to achieve compatibility with equipment that interfaces with that system.

E. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

F. Coordinate equipment with Division 26 Section "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.

G. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

H. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

I. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Replacement Materials: One replacement diaphragm or relay mechanism for each unique valve motor, controller, and thermostat.
2. Maintenance Materials: One thermostat adjusting key(s) per floor or 50,000 sqft of total conditioned space, whichever is greater.
3. Maintenance Materials: One pneumatic thermostat test kit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS. The Following Manufactures are accepted for the expansion of an existing or installation of a new Building Management System constructed using the Niagara 4 Framework with BACnet, LonWorks, Modbus, Field Level Devices. The BMS shall utilize single or multiple controller(s), networked with a Niagara Framework Web Supervisor or the Corporate Web Supervisor.

A. Allerton.

B. Distech Controls.

C. Delta Controls.

D. Honeywell.

E. KMC.

F. Tridium Niagara N4 (basis for design).

G. Vykon.

2.2 GENERAL REQUIREMENTS

A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the provision, installation and extension of the existing building automation and Control System (FMS) including all related systems and accessories.

B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems.

C. System points lists included in the Documents are intended to show the desired alarm, monitoring and control points. Add any control points necessary and as required to accomplish the sequence of operations.

D. D. The BMS shall use Niagara Framework capable of communicating over an Ethernet system. It shall be capable of residing on the corporate enterprise WAN/LAN by having assigned IP address and/or Host name. BMS systems are required to permit a remote user with password access, monitor points and issue basic commands over the corporate enterprise WAN/LAN using a PC and iPad type terminal without the need for proprietary BMS software. The system front end shall reside on a server not a PC.

E. Connection by remote FMS to be accommodated by allowing polling of FMS parameters over an open protocol such as BACnet and Modbus TCP.

F. Provide a UPS with a minimum of 15 minute backup for all building controllers to prevent disruption during a temporary loss of power, including where the loss of memory, program content, or control function may result.

G. Provide a UPS with a minimum of 15 minute backup for all AHU damper actuators to prevent closure during a temporary loss of power.

H. HOA control is required for all outputs used to control AHU, Plant, Pump, or Facility Infrastructure Equipment. The Jace IO will need to be located at each of the AHU's it serves.

I. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics. Obtain and match sample graphics from Owner for all systems.

J. The control system shall also include a paging feature with telephone/email alerts to selected personnel for critical alarms as defined by Owner.

K. The control system shall be connected to the facility LAN and shall permit at least 4 simultaneous users to access the system over the LAN, based on password level, monitor parameters, change set points, set up trends, or start/stop controlled equipment. A remote user shall have this capability without having the system data base loaded on his/her remote computer

L. All terminal box controller parameters shall be mapped to the front end of the FMS.

M. For AHUs, each individual operating state shall have an individual PID control loop for that state.

N. BMS Graphics and Theme, Dynamic animated color graphic displays

1. BMS Graphics Screen Size and aspect Ratio

a. 1920x1080 16:9

2. General Theme

a. Acceptable Typography

1) Effra- Primary body type (Effra Font)
2) Roboto Slab- Headline and Subhead type (Roboto Slab Font)

b. Acceptable Colors

1) Primary Colors

a) Blue 281 (#00205b)
b) Pure White (#ffffff)

2) Secondary Colors

a) Cool Gray 10 (#63666a)
b) Cool Gray 9 (#75787b)
c) Cool Gray 8 (#d8d8d8)
d) Light Gray (#f8f8f8)
e) Blue Gray (#f5f8ff)

3) Accent Colors (web only)

a) Blue (#0577b3)
b) Green (#218e03)

c. Logos

1) All vendor and controls brands logos must not be visible on BMS. BMS should be branded with Owner logos
2) Owner logo folder can be found at the following link.

3. Color graphic floor plan displays, and system schematics for each piece of mechanical equipment (including air handling units, variable air volume boxes, fan coils, unit ventilators, cabinet heaters, exhaust fans, fin tube radiation, chilled water systems, hot water boiler systems, and so forth) shall be provided, as specified in the point lists of the Documents, in order to optimize system performance analysis, speed alarm recognition, and simplify user interaction. Configure the color graphics and plot all associated control/monitoring points on the screen. Copies of all color graphics screens shall be provided as color printouts to the engineer and to Owner for approval. Obtain and match sample graphics from Owner for all systems.
4. System Selection/Penetration: The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, or test-based commands. Floor plans shall display room numbers and each zone shall be color-coded. The operator shall be able to point and click on a room or zone of rooms (in the case of an air handler that serves more than one zone). The room or zone will display an animated flow diagram of the mechanical equipment that serves that zone, with all control and monitoring points associated with that piece of equipment, including setpoints. Setpoints shall be overridden or modified from this screen.

a. Navigation

1) All sites must have a navigation tree on the left side with devices structured and nested according to where they physically reside. VAVs for a specific AHU shall be nested under that specific AHU to provide easier navigation as well quicker troubleshooting.

a) Jace level
b) Air Handler level

c) VAV level

b. All pages must have BMS navigation bar to go back and forth between floors of the building as well as the central plant.

c. All writable points will have the following options set.

1) Emergency override (hidden)
2) Emergency Auto (hidden)
3) Operator Override
4) Operator Auto
5) Set (hidden to all but "Super Users")

5. Dynamic Animated Data Displays: Dynamic temperature values, humidity values, flow values, and status indication shall be shown in their actual respective locations, and shall automatically update to represent current conditions without operator intervention. Damper and valve positions, air and water flow shall be animated and shall represent actual, current conditions.
6. System Performance Analysis Screens: System performance analysis screens shall be provided for the major mechanical systems (such as air handlers, chillers, boilers, and so forth.). For each of these systems, the screen shall be split into quadrants, simultaneously displaying the following data:

a. Quadrant 1. – Dynamic animated flow diagrams.
b. Quadrant 2. – All analog values associated with the mechanical system shall be graphed on an X-Y axis graph. Five-minute samples for the last twenty-four-hour period shall plotted. Scaling shall be automatic.
c. Quadrant 3. – Text sequence of operations from engineering as-built submittals.
d. Quadrant 4. – Space temperature summaries from each zone being served by mechanical system.

7. Windowing: The windowing environment of the PC Operator Workstation shall allow the user to simultaneously view several graphics at the same time to analyze total building operation, or to allow the display of a graphic associated with an alarm to be viewed without interrupting Work in progress.
8. Alarm Annunciation: Any point in a state of alarm shall change the color of its symbol to red until it is no longer in alarm.

a. There shall be an alarm console set up for all alarming on site.

1) All alarms must have a description of what the alarm is, when it happened, whether it is acknowledged or not, and the priority of the alarm.
2) Option to acknowledge each alarm needs to be displayed for easy acknowledgement
3) After acknowledgement the graphics shall display the user that acknowledged the alarm.

b. Critical Alarms shall be annunciated via email and SMS to designated recipients.

9. AHU Summary Graphic Screen: Obtain and match sample graphics from Owner for all systems. An AHU summary graphic screen shall be provided for economizer and non economizer AHU's as follows:

a. AHU's without economizer cycles shall include a summary graphic screen including the following information:

1) Air Handling Unit

a) AHU number
b) Supply air temperature
c) Supply air temperature setpoint
d) Supply air cfm setpoint
e) Total terminal box airflow
f) Chilled water valve position in %
g) Return air temperature
h) Return air humidity in %
i) Outside air temperature
j) Outside air humidity

2) Chilled Water Secondary System

a) Chilled water supply temperature
b) Chilled water return temperature
c) Chilled water flow in gpm
d) Building load in tons
e) Chilled water system differential pressure
f) Chilled water system differential pressure setpoint
g) Each chilled water pump speed in %

3) Chillers

a) Each chiller, chilled water supply temperature.

b. AHU's with economizer cycles shall include a summary graphic screen including the following information:

1) Air Handling Unit

a) AHU number
b) Supply air temperature
c) Supply air temperature setpoint
d) Return air temperature
e) Outside air temperature
f) Outside air humidity
g) Mixed air temperature

2) Outside Air

a) Outside air cfm setpoint
b) Outside air cfm measured
c) Return fan speed %
d) Supply Fan speed %
e) Supply static pressure setpoint
f) Supply static pressure actual

3) Dampers

a) Economizer damper open position %

O. Systems integration/FMS specific requirements

1. FMS Remote Access: The Facility Management System provided shall include the capability for multiple users to access the FMS simultaneously from remote locations via the Internet. Internet access shall be accomplished by use of standard Internet browser software applications such as Google Chrome ® or Microsoft Internet Explorer ® and shall not require the use of proprietary access software. Interface shall be to the entire FMS and provide capability to monitor all I/O and adjust parameters.
2. Open Systems Integration: VFD Integrator Interface

    a. The FMS shall include appropriate hardware equipment and software to allow two-way data communications between the FMS and the VFD manufacturer's control panel.
    b. Coordinate with the VFD manufacturer to provide a functional data communications connection.
    c. All data supported by the VFD communication protocol shall be mapped into the supervisory DDC controller's database and shall be displayed on data screens at the Operator Workstation and shall be transparent to the operator.
    d. Furnish a BACnet communications interface as required by the VFD manufacturer.
    e. Provide all communications and power wiring and gateway panel installation for the DDC system. The VFD manufacturer shall provide all hardware for connection of the manufacturer's processor.
    f. Provide all hardware and software required for the VFD manufacturer's gateway interface.
    g. Connection to more than six VFD's on a single network shall be made on a dedicated field bus.

3. Open Systems Integration: Chiller Integrator Interface

    a. The FMS shall include appropriate hardware equipment and software to allow two-way data communications between the FMS and the chiller manufacturer's chiller control panel.
    b. Coordinate with the chiller manufacturer to provide a functional data communications connection.
    c. All data supported by the chiller communication protocol shall be mapped into the supervisory DDC controller's database and shall be displayed on a chiller data screen at the Operator Workstation and shall be transparent to the operator.
    d. Furnish a BACnet communications interface as required by the chiller manufacturer.
    e. Provide all communications and power wiring and gateway panel installation for the DDC system. The chiller manufacturer shall provide all hardware for connection of the manufacturer's processor.
    f. Provide all hardware and software required for the chiller manufacturer's gateway interface.

4. Open Systems Integration: Boiler Integrator Interface

    a. The FMS shall include appropriate hardware equipment and software to allow two-way data communications between the FMS and the boiler manufacturer's Master Boiler Controller Control Panel.
    b. Coordinate with the boiler manufacturer to provide a functional data communications connection.
    c. All data supported by the boiler communication protocol shall be mapped into the supervisory DDC controller's database and shall be displayed on a boiler data screen at the Operator Workstation and shall be transparent to the operator.
    d. Furnish BACnet communications interface as required by the chiller manufacturer.

e. Provide all communications and power wiring and gateway panel installation for the DDC system. The boiler manufacturer shall provide all hardware for connection of the manufacturer's processor.
f. Provide all hardware and software required for the boiler manufacturer's gateway interface.

5. Open Systems Integration: Critical Systems (Room pressure, Room temperature, Room Humidity, Med Gas)

a. The BMS shall include appropriate hardware equipment and software to allow two-way data communications between the BMS and the critical systems manufacturer's control panel.

b. Coordinate with the critical systems manufacturer to provide a functional data communications connection.

c. All data supported by the VFD communication protocol shall be mapped into the supervisory DDC controller's database and shall be displayed on data screens at the Operator Workstation and shall be transparent to the operator.

d. Furnish a BACnet communications interface as required by the critical systems manufacturer.

e. Provide all communications and power wiring and gateway panel installation for the DDC system. The VFD manufacturer shall provide all hardware for connection of the manufacturer's processor.
f. Provide all hardware and software required for the VFD manufacturer's gateway interface.

P. Alarm management

1. Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each DDC panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, to minimize network traffic, and to prevent alarms from being lost. At no time shall the DDC panel's ability to report alarms be affected by either operator activity at a PC Workstation or local I/O device, or communications with other panels on the network.
2. Point Change Report Description: All alarm or point change reports shall include the point's English language description, and the time and date of occurrence.
3. Prioritization:

a. Set up all system analog points with high and low alarm limits. All digital system points shall be associated with a status feedback point and all exceptions shall be reported as alarms. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized and filtered to minimize nuisance reporting and to speed operator response to critical alarms.
b. The user shall also be able to define under which conditions point changes need to be acknowledged by an operator, and/or sent to follow-up files for retrieval and analysis at a later date.

4. Critical and Non-Critical Alarm Routing:

a. Critical alarms shall be defined as chiller, boiler, generator, critical space temperature or humidity, and kilowatt demand approaching threshold. Critical alarms shall be displayed at the workstation, printed at the alarm printer, and alpha paged to the on-duty maintenance person over the Owners alphanumeric paging system. Alpha pages shall provide sufficient information to identify the equipment and the point in alarm and the time and date of occurrence.
b. All other alarms shall be considered non-critical and shall be displayed and acknowledged before being sent to the alarm log.

5. Report Routing: Alarm reports, messages, and files will be directed to a user-defined list of operator devices, or PCs used for archiving alarm information. Alarms shall also be automatically directed to a default device in the event a primary device is found to be off-line.
6. Alarm Messages:

a. In addition to the point's descriptor and the time and date, the user shall be able to print, display, or store a 65-character alarm message to more fully describe the alarm condition or direct operator response.
b. Each stand-alone DDC panel shall be capable of storing a minimum library of 250 Alarm Messages. Each message may be assignable to any number of points in the panel.

7. Auto-Dial Alarm Management: In Dial-up applications, only critical alarms shall initiate a call to a remote operator device. In all other cases, call activity shall be minimized by time-stamping and saving reports until an operator scheduled time, a manual request is made, or until the buffer space is full. The alarm buffer must store a minimum of 50 alarms.

2.3 DDC EQUIPMENT

A. Operator Workstation: Not required.

2.4 GLOBAL, PLANT and AHU CONTROLLERS

A. Control Units: Must be Niagara 8000 Jace or equivalent Niagara 8000 processor board with programmable, nonvolatile, random-access memory; local operator access; integral interface equipment; and backup power source.

1. Licensing

a. Open licensed to accept "*" in Niagara workbench connection local or remote interface provides for download from or upload to Supervisor Server or ROC diagnostic laptops.
b. Must support all connected unitary controllers that it supports plus 10% reserved license capacity.
c. Must allow for remote configuration of its self and all connected terminal units from the Supervisor and ROC diagnostic laptops.
d. All licensing must be for Life. No subscriptions or expirations are allowed.

2. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.

3. Stand-alone mode control functions operate regardless of network status. Functions include the following:

a. Global communications.
b. Discrete/digital, analog, and pulse I/O.
c. Monitoring, controlling, or addressing data points.
d. Software applications, scheduling, trending, and alarm processing.
e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

4. Application Programing:

a. Program logic fully editable from within Niagara N4 wire sheet view on Supervisor and ROC diagnostic laptops local and remote.
b. Programming will be organized in logic folders and easily traceable.
c. Third party modules must receive explicit Owner approval to be used.
a. Support Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, anti-short cycling, PID control, trend logging, alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access. Support the sequence of operation for the equipment that it directly controls.
b. Remote communications.
c. Maintenance management.
d. Units of Measure: US impiral

B. I/O Interface: Hardwired inputs and outputs may tie into system through dedicated I/O modules. Protect points so that shorting will cause no damage to module.

1. Binary Inputs: Allow monitoring of on-off signals without external power.

2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.

3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.

4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.

5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.

6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.

7. Universal I/Os: Provide software selectable binary or analog outputs.

8. AHU I/O modules must be and easily accessible and within proximity to the AHU.

9. Central plant I/O may be located at centralized panels for control of multiple pieces of equipment.

10. All I/O must be clearly labeled and have a printed termination schedule or schematic located within the panel.

C. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. 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. second 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.

D. Power Line Filtering: Internal or external transient voltage and surge suppression for work-stations or controllers with the following:

1. AC Suppression Joule Rating: 3840

2. AC Suppression Response Time: NM = 0 ns. CM = <1 ns

3. Protection Modes: Includes full normal mode (H-N) and common mode (N-G / H-G) line surge suppression

4. Clamping Voltage (RMS): 140

5. AC Suppression Surge Current Rating: 97,000 amps (36,000 NM / 61,000 CM)

6. AC Suppression Components Used Metal oxide varistors, toroidal balanced chokes, ferrite rod-core inductors and VHF capacitors.

7. Safe Thermal Fusing: Prevents unsafe conditions during extreme extended over-voltages and catastrophic occurrences

8. UL1449 Let Through Rating 330V

9. IEEE587 Cat. A Ringwave Let-Through: Less than 35 volts

10. EMI / RFI Filtering: 40-80 dB

11. Isolated Filter Banks: 4

12. Immunity: Conform to IEE 587 / ANSI C62.41

2.5 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration Software: Launchable from within Niagara Framework allowing fully accessibility both on and offsite. Must allow remote support from within the Owner network.
2. Local Configuration: diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; battery or non-volatile flash memory backup.
3. Enclosures:
   a. For Conditioned Space: Dustproof rated for operation at 32 to 120 deg F.
   b. For Outdoor and Non-conditioned Space: Waterproof rated for operation at -10 to 150 deg F.

2.6 ALARM PANELS

A. Unitized cabinet with suitable brackets for wall or floor mounting. Fabricate of 0.06-inch-thick, furniture-quality steel or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish. Provide common keying for all panels.

B. All outputs must include HOA overrides

1. All I/O must be clearly labeled and have a printed termination schedule or schematic located within the panel.

2.7 INPUT DEVICES

A. General Requirements: Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

B. Temperature Sensors

1. General Requirements:
   a. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
   b. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:
      1) 0.37 deg F:
         a) Chilled Water.
         b) Room Temperature.
         c) Duct Temperature.
      2) 0.5 deg F: All others

2. Room Temperature Sensors

a. Room sensors shall be constructed for either surface or wallbox mounting.
b. Room sensors shall have the following options:

1) Setpoint reset slide switch providing a +5 degree (adjustable) range.
2) Individual heating/cooling setpoint slide switches.

c. In Operating Rooms and Endoscopy Room, use Vaisala HMW9x sensor.

3. Room Temperature Sensors with Integral Display:

a. Room sensors shall be constructed for either surface or wallbox mounting.
b. Room sensors shall have an integral LCD display and four button keypad with the following capabilities:

1) Display room temperature.
2) Display and adjust room comfort setpoint.
3) Display and adjust fan operation status.
4) Timed override request push button with LED status for activation of after-hours operation.
5) Display controller mode.
6) Password selectable adjustment of setpoint and override modes.

4. Thermowells:

a. When thermowells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting.
b. Thermowells shall be pressure rated and constructed in accordance with the system working pressure.
c. Thermowells and sensors shall be mounted in a threadolet or 1/2" NFT saddle and allow easy access to the sensor for repair or replacement.
d. Thermowells shall be constructed of 316 stainless steel.

5. Outside Air Sensors:

a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
b. Sensors shall be shielded by a perforated plate that surrounds the sensor element.
c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.

6. Duct Mount Sensors:

a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

7. Averaging Sensors:

a. Similar to JCI TE6300.
b. For ductwork greater in any dimension than 48 inches, inside air handling units, and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.

c. A 20 foot averaging continuous sensor shall be serpentine across the cross section with minimum 1 foot of length for every square foot of cross sectional area. Capillary supports at the sides of the duct shall be provided to support the sensing string.

C. Current Sensing Relays

1. Current sensor shall induce power from the monitored load and shall have an adjustable operating range from 2.5 - 135 A.
2. Visual indicators (LED's) shall indicate output status and sensor power.
3. Adjustable trip set point to +/- 1%.

D. Humidity Sensors:

1. Acceptable Manufacturers: Vaisala preferred, Varis, General Eastern, and Johnson Controls. In Operating Rooms and Endoscopy Room, use Vaisala HMW9x sensor.
2. The sensor shall be a solid state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.
3. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA or 3 wire 0-10VDC, 0-100% linear proportional output.
4. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion.

   a. Indoor locations and sensors mounted in air handling units or ducts; +/- 3%.
   b. Outdoor locations: Humidity Sensor shall be HyCal +/- 2 %.

5. Outside air relative humidity sensors shall include a rain proof, perforated cover. The transmitter shall be include in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.
6. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
7. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.

E. Differential Pressure Transmitters:

1. Air and Water Pressure Transmitter Requirements:

   a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
   b. Differential pressure transducers shall be piped to permit equalizing pressure prior to disconnecting.
   c. Differential pressure sensors used to control equipment such as fans and pumps, shall be connected directly to the same controller that controls the equipment to insure the continued proper operation of the controlled equipment without dependence on the control network.

2. Room Differential Pressure Controller and sensor and transmitter acceptable models:

   a. ALL PRESSURE CRITICAL SPACES MUST BE ACTIVLY CONTROLLED
   b. TSI Pressura RPC30
   c. CRC Room Pressure Monitor / Controller <u>(only on specific case-by-case approval from Owner)</u>

F. Flow measuring devices:

1. Air Flow Measuring:

a. General:

1) Airflow measuring sensors shall be installed at fan inlet whenever possible and shall be capable of continuously measuring the air handling capacity (air volume) of the respective centrifugal, plug, or vane-axial fan(s).

b. Manufacturers:

1) Paragon Controls Incorporated (PCI).
2) Air Monitor Corporation
3) MicroTrans EQ

c. Fan Inlet Piezometer Ring

1) Factory tap fan inlet with sensor ports.
2) Accuracy: +/-3% of Full Scale.
3) Provide one (1) ring on each fan in each array, with signal combiner per array, which does not include signal from off-line fans in combined signal.

d. Duct mounted:

1) Manufacturers:

a) Air Monitor Corporation

2) Description: Thermal dispersion type. Units shall be provided complete with differential pressure transducers, temperature compensation, square root extraction. Unit shall perform all internal calculations to output to the FMS the CFM readings.
3) Location: Provide straight duct before and after device according to the sensor manufacturer's recommendations. Provide access door in ductwork adjacent to sensors.
4) Accuracy: Sensor accuracy shall be +/- 2% of the airflow reading over the entire range of airflow measured.
5) Provide air flow measuring station at AHU relief air.

e. Transmitter / Transducer

1) Each sensor shall be provided complete with transmitter.
2) Manufacturers:

a) Paragon

3) Full Scale Accuracy:

a) Accuracy: +/- 0.25% of Full Scale.
b) Terminal Point Non-linearity: +/- 0.2%.
c) Hysteresis: +/- 0.2%.
d) Non-repeatability: +/- 0.3%.
e) Temperature Effect: +/- 0.15% Full Scale / °F.

4) The transmitter-controller shall be capable of receiving flow signals (total and static pressure) from an airflow station or probe array and produce an output linear and scaled for air volume, velocity, differential pressure, etc. The internal P, I, three-mode controller shall be capable of controlling at a user selectable internal or external setpoint, and output a 0-5VDC, 0-10VDC, or 4-20mADC control signal.
5) The transmitter-controller shall contain an integral multi-line digital display for use during the configuration and calibration process, and to display one transmitter output plus controller setpoint during normal operating mode. All transmitter configuration, parameter setting, zero and span calibration, plus display formatting and scaling will be performed digitally in the on-board microprocessor via input pushbuttons.
6) The transmitter-controller will be available in multiple natural spans covering the range of 0.05" w.c. to 10.0" w.c. The transmitter-controller shall be furnished with a transducer automatic zeroing circuit, and be capable of maintaining linear output signals on applications requiring 10 to 1 velocity or pressure turndown.
7) The transmitter-controller shall be capable of having its operating span electronically selected without having to perform recalibration involving an external pressure source. The transmitter-controller will provide the means of managing a system for automatic high pressure purge of the airflow station or probe array, with user selectable purge frequency and duration, while maintaining the last transmitter output during the purge cycle. Using a second transmitter as an input, the internal microprocessor can perform a summed flow, flow differential, low signal select, high signal select or percent deviation calculation, with the result being displayed and provided as an analog output signal.

2. Water Flow Measuring:

a. General:

1) Sensors shall operate in line pressures up to 400 psi and liquid temperatures up to 220° F.
2) A certificate of calibration shall be provided with each flow meter.
3) Each flow meter shall be covered by the manufacturer's two-year warranty.

b. Electromagnetic

1) Manufacturer:

a) Onicon, F-3500 Series.

2) Accuracy:

a) Less than 2 ft/sec: ± 0.02%.
b) 2 to 30 ft/sec: ± 1%.

3) Provide complete sensor assembly with all installation hardware necessary to enable insertion and removal of the meter without system shutdown.
4) Materials of construction for wetted metal components shall be 316 SS.
5) The flow meter shall average velocity readings from two sets of diametrically opposed electrodes.
6) Each flow meter shall be individually wet-calibrated against a primary volumetric standard that is accurate to within 0.1%.
7) Output signals shall be completely isolated and shall consist of the following:

a) (1) analog output; 4-20mA, 0-10V, or 0-5V jumper selectable
b) (1) scalable dry contact output for totalization
c) (1) high resolution frequency output for use with peripheral devices such as an ONICON display module or Btu meter.

c. Paddle

1) Manufacturers:

a) Onicon, F-1300 Series

2) Accuracy: ± 1% from 2 to 20 ft/sec.
3) The flow sensor shall be an insertion type with a non-magnetic, spinning impeller as the only moving part.
4) The sensor sleeve shall be 316 stainless steel with the sensor housing being glass-filled PPS.
5) The impeller shall be glass-filled nylon or Tefzel® with a UHMWPE or Tefzel® sleeve bearing.
6) The shaft material shall be tungsten carbide.
7) The flow sensor shall be supplied with a 2" full bore ball valve in 316 stainless steel and a 2" threaded pipe nipple.
8) A bleed valve and three ethylene-polypropylene O-Rings shall be incorporated into the mounting adapter portion of the sensor.
9) A removable installation tool, Model HTT, shall be provided with sensor and be attachable to the sensor for insertion or removal of the flow sensor from the pipe.
10) Insertion of the sensor into any pipe size shall be a fixed 1 ½" depth from the inside wall to the end of the sensor housing.

d. Transmitter / Transducer

1) Each sensor shall be provided complete with transmitter.
2) Water meter: The analog transmitter shall be Data Industrial Model 310-00, or equivalent.
3) The analog flow transmitter shall be a loop powered device capable of transmitting a linear 4 - 20 mA signal proportional to frequency. The unit shall be microprocessor controlled with no switches or potentiometers to set.
4) The transmitter shall meet ISA Class L, H and U non-isolated requirements. All circuitry shall be encapsulated in a low profile epoxy body to meet MIL spec M.1- 146058C type AR, for humidity, moisture and fungus resistance. Operating range shall be 35°F to 150°F.
5) All programming, including flow sensor selection, pipe size, flow range setting, response time and filtering shall be set digitally via a computer using Windows-based software with programming kit (disk and cable). The transmitter shall be easily programmed in the field using a standard computer.
6) The transmitter shall have a ground lug to maximize EMI protection when necessary. The transmitter shall be mounted directly near the insertion flow sensor on a DIN Rail, as a panel mount or in a weather proof or NEMA 4X enclosure.

3. BTUH Meter

a. BTUH Meter shall be Onicon System 10 or Belimo Energy Valve.
b. Insertion type, electromagnetic flow meter as indicted above.
c. Calibration: NIST traceable calibration for meter and solid state temperature sensors.

d. Temperature sensors: Solid state with differential temperature accuracy of +/- 0.15 degree F over calibrated range.
e. Communication: BACnet compatible derail communication over MS/TP.

G. Power Monitoring Devices:

1. Current Measurement (Amps):

a. Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Facility Management System.
b. Current Transformer – A split core current transformer shall be provided to monitor motor amps.

1) Operating frequency – 50 - 400 Hz.
2) Insulation – 0.6 Kv class 10Kv BIL.
3) UL recognized.
4) Five amp secondary.
5) Select current ration as appropriate for application.

c. Current Transducer – A current to voltage or current to mA transducer shall be provided. The current transducer shall include:

1) 6X input over amp rating for AC inrushes of up to 120 amps.
2) Manufactured to UL 1244.
3) Accuracy: +.5%, Ripple +1%.
4) Minimum load resistance 30kOhm.
5) Input 0-20 Amps.
6) Output 0-10V.
7) Transducer shall be powered by a 24VDC regulated power supply (24 VDC +5%).

H. Smoke Detectors:

1. Ionization type air duct detectors shall be furnished as specified elsewhere in Division 26 for installation under Division 23. All wiring for air duct detectors shall be as specified in Division 28 - Fire Alarm System.

I. Status and Safety Switches:

1. General Requirements:

a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the FMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

2. Current Sensing Switches:

a. The current sensing switch shall be self-powered with solid state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.

b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

3. Air Filter Status:

a. Differential pressure sensor with analog output used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.
b. A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters.
c. Provide appropriate scale range and differential adjustment for intended service.

4. Air Flow Switches:

a. Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.

5. Air Pressure Safety Switches:

a. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
b. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.

6. Water Flow Switches: Equal to the Johnson Controls P74.
7. Low Temperature Limit Switches: Equal to Johnson Controls A70.

a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
b. The sensing element shall be one foot long for each square foot of coil area and be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
c. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.

J. EPO Switches

1. General Description: All products listed shall meet the following requirements:

a. Operators shall be heavy duty type and comply with UL Type 13/NEMA Type 13 and UL Type 6/NEMA Type 6.
b. Contact blocks shall be rated 10 amperes continuous.

2. EPO Design:

a. Mushroom type: Flush mounted, two position, maintained push - maintained pull mushroom head type push button operator with 2.25 inch diameter mushroom top, red, with one normally open and one normally closed (1NO - 1NC) contact. Provide with aluminum extended mushroom guard.

b. Push button type: Flush mounted, two position, momentary push button, red insert, with one normally open and one normally closed (1NO - 1NC) contact. Provide with a hinged, lockable protective cover guard.

2.8 OUTPUT DEVICES

A. Actuators:

1. General Requirements:

a. Damper and valve actuators shall be electronic, as specified in the System Description section.

2. Electronic Damper Actuators:

a. Electronic damper actuators shall be direct shaft mount, as manufactured by Johnson Controls and Belimo.
b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, or a gear release to allow manual positioning.
c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, proportional control.
d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.

3. Electronic Valve Actuators:

a. Electronic valve actuators shall be manufactured by the valve manufacturer or Belimo Air Controls. Each actuator shall have current limiting circuitry incorporated in its design to prevent damage to the actuator.
b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Actuators shall provide the minimum torque required for proper valve close off against the system pressure for the required application. The valve actuator shall be sized based on valve manufacturer's recommendations for flow and pressure differential. All actuators shall fail in the last position unless specified with mechanical spring return in the sequence of operations. The spring return feature shall permit normally open or normally closed positions of the valves, as required. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.
c. Modulating Actuators shall accept 24 VAC or VDC and 120 VAC power supply and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, proportional control.

d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Butterfly isolation and other valves, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop the associated pump or chiller.

B. Control Dampers:

1. Furnish all automatic dampers that are not furnished with air handling units. Coordinate exact damper requirements with the air handling unit manufacturer. All automatic dampers shall be sized for the application or as specifically indicated on the Drawings.
2. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.
3. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
4. All dampers used for smoke control applications shall be UL 555 listed.
5. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 48". Damper blades shall be 16-gauge minimum and shall not exceed six (6) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. Additional stiffening or bracing shall be provided for any section exceeding 48" in height. All damper bearings shall be made of stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomeric seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.5 cfm per square foot when closed against 4" w.g. static pressure when tested in accordance with AMCA Std. 500.
6. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g. Acceptable manufacturers: Johnson Controls D-1300, Ruskin CD50, and Vent Products 5650.
7. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below.
8. Acceptable manufacturers: Johnson Controls D-1100, Ruskin CD36, and Vent Products 5800.
9. Multiple section dampers may be jack-shafted to allow mounting of piston pneumatic actuators and direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

C. Control Relays:

1. Control Pilot Relays:

a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
b. Mounting bases shall be snap-mount.
c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
d. Contacts shall be rated for 10 amps at 120VAC.
e. Relays shall have an integral indicator light and check button.

D. Control Valves: Provide Belimo ePIV or approved equal.

1. All automatic control valves shall be fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation and fail-safe open, closed, or in their last position. All valves shall operate in sequence with another valve when required by the sequence of operations. All control valves shall be sized by the control manufacturer and shall be guaranteed to meet the heating and cooling loads, as specified. All control valves shall be suitable for the system flow conditions and close against the differential pressures involved. Body pressure rating and connection type (sweat, screwed, or flanged) shall conform to the pipe schedule elsewhere in this Section.
2. Chilled water control valves shall be modulating type as required by the specific application. Modulating water valves shall be sized per manufacturer's recommendations for the given application. In general, valves (2 or 3-way) serving variable flow air handling unit coils shall be sized for a pressure drop equal to the actual coil pressure drop, but no more than 5 PSI. Valves (3-way) serving constant flow air handling unit coils with secondary circuit pumps shall be sized for a pressure drop equal to 25% the actual coil pressure drop, but no more than 2 PSI. Mixing valves (3-way) serving secondary water circuits shall be sized for a pressure drop of no more than 5 PSI. Valves for terminal reheat coils shall be sized for a 2 PSIG pressure drop, but no more than a 5 PSI drop. Chilled water control valves at Air Handling Unit cooling coils shall be Belimo Energy Valve, including characterized control valve, sized for design flow rates.

3. Ball valves shall be acceptable for water terminal reheat coils, radiant panels, unit heaters, package air conditioning units, and fan coil units.
4. Control valves for ball valves shall not use pulse of tri-mode controllers or actuators. Controllers installed shall be capable of being spanned for the two stem travel ranges of 0-20% open and 85-100% open.
5. Heating water valves shall use pressure-independent control valve, sized for design flow rates.

E. Electronic Signal Isolation Transducers:

1. A signal isolation transducer shall be provided whenever an analog output signal from the Facility Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input signal from a remote system.
2. The signal isolation transducer shall provide ground plane isolation between systems.
3. Signals shall provide optical isolation between systems.

F. Motor starters: an integral HAND/OFF/AUTO switch shall override the controlled device pilot relay.

1. A status input to the Facility Management System shall indicate whenever the switch is not in the automatic position.
2. A Status LED shall illuminate whenever the output is ON.
3. An Override LED shall illuminate whenever the HAND/OFF/AUTO switch is in either the HAND or OFF position.
4. Contacts shall be rated for a minimum of 1 amp at 24 VAC.

G. Variable frequency motor controllers: an integral HAND/AUTO pushbutton shall override the controlled device pilot relay.

1. A status input to the Facility Management System shall indicate whenever the controller is in the hand or bypass position.
2. A Status LED shall illuminate whenever the output is ON.
3. An Override LED shall illuminate whenever the HAND/AUTO pushbutton is in either the HAND or OFF position.

4. Contacts shall be rated for a minimum of 1 amp at 24 VAC.

2.9 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling."

2.10 SEQUENCES OF OPERATION

A. See drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditioned power supply is available to control units and operator workstation.

3.2 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

1. Connect and configure equipment and software to achieve sequence of operation

B. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and architectural room details before installation. Install devices 48 inches above the floor.

C. Install manual reset switches, such as high and low static resets, no higher than 6'-0" above nearest adjacent finished floor.

D. Install averaging elements in ducts, plenums, and coil faces in crossing or zigzag pattern. Provide one linear foot of sensor per square foot of coil in a pattern that will create an even distribution of sensor over the entire cross sectional area of duct or air handling unit.

E. Install freezestats to provide one linear foot of sensor per square foot of coil.

F. Install temperature sensor on the leaving side of all cooling and heating coils in AHUs.

G. Install outdoor air temperature sensors on a north facing wall and away from direct sunlight as well as 20 feet (minimum) from exhaust or relief air fans.

H. Install outdoor air humidity sensors on a north facing wall and away from direct sunlight as well as 20 feet (minimum) from exhaust or relief air fans. Do not install within 20 feet of cooling tower discharge, steam vents, or downstream of similar services in the direction of typical wind patterns.

I. Install guards on thermostats in the following locations:

1. Entrances.
2. Public areas.
3. Where indicated.

J. Install BTU meters for the following systems:

1. Chilled Water.
2. Heating Water.

K. Flow Station Locations:

1. Air side

a. Provide piezometer ring type at fan inlet for all fans located in AHUs and as indicated on drawings.

b. Duct mounted flow stations shall be thermal dispersion type.

L. Install pressure monitors across walls dividing a spaces with monitored pressure requirements, including the following applications:

1. Operating Rooms
2. Endoscopy.

M. Coordinate EPO switch location and type with Division 26. Install EPOs as follows:

1. Mushroom or push button:

a. Chillers

N. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

O. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

P. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

Q. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."

R. Install steam and condensate instrument wells, valves, and other accessories according to Division 23 Section "Steam and Condensate Heating Piping."

S. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."

T. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

U. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

V. Unit Heaters: Unit heaters shall each be provided with a low voltage electric wall-mounted room thermostat, which shall cause the heater to be cycled "on" or "off" as required to satisfy the thermostat setting. Control circuit voltage shall not exceed 120 volts to ground. In the off position, water shall be circulated through the unit.

W. Cooling Tower Basin Heating: When the outside air temperature reaches 35 degrees F. (adj.), the cooling tower basin heating system shall be activated to maintain a 40 degree F. basin water temperature.

X. Provide total terminal box airflow for each AHU to be shown as separate point in the FMS graphics in addition to the AHU supply airflow, in CFM, set point.

3.3 EQUIPMENT STATUS MONITORS

A. Current sensing relays are to be installed across motors and must be sensitive enough to detect and alarm when driven equipment, such as a fan motor is operating without a belt or a pump motor is operating without flow.

B. Where a current sensing relay is not sensitive as described above, provide differential pressure transducers/switches to monitor equipment status.

3.4 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway, or in a wire basket system, or bundled, labeled for service, and well supported to prevent contact with other systems].
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. 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 or hand/auto push buttons to override automatic interlock controls when switch or pushbutton is in hand position.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. 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 calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check installation of air supply for each instrument.
6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
8. Check temperature instruments and material and length of sensing elements.
9. Check control valves. Verify that they are in correct direction.
10. Check DDC system as follows:

    a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    c. Verify that spare I/O capacity has been provided.
    d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.6 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. Control System Inputs and Outputs:

    a. Check analog inputs at 0, 50, and 100 percent of span.
    b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
    c. Check digital inputs using jumper wire, including:

        1) Status indicators for fans shall be tested to indicate an alarm upon belt loss or dead-head pump condition. Adjust current sensing relays appropriately.

2) Status indicators for preheat circulating pumps shall be tested to indicate an alarm upon dead-head condition. Adjust current sensing relay appropriately.

d. Check digital outputs using ohmmeter to test for contact making or breaking.
e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:

a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
b. Manually operate flow switches to verify that they make or break contact.

6. Pressure:

a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

7. 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.

8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. 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.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide for visits to Project during other than normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 230900

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes pipe and fitting materials, and joining methods for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Condensate-drain piping.
4. Air-vent piping.

B. Related Sections include the following:

1. Division 23 Section "Expansion Fittings and Loops for HVAC Piping" for expansion fittings.
2. Division 23 Section "General-Duty Valves for HVAC Piping" for valves and accessories for piping.
3. Division 23 Section "HVAC Insulation – Duct, Equipment, and Piping" for pipe saddles at pipe hangers.
4. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.
5. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for seismic and wind restraint requirements.

## 1.2 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding 150 psig at the corresponding temperature as the minimum working pressure and temperature, unless otherwise indicated:

1. Hot-Water Heating Piping: 200 deg F.
2. Chilled-Water Piping: 200 deg F.
3. Condensate-Drain Piping: 200 deg F.
4. Air-Vent Piping: 200 deg F.

## 1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air control devices.
3. Hydronic specialties.

B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

## 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

1.6 EXTRA MATERIALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.

E. Wrought-Copper Unions: ASME B16.22.

F. Copper or Bronze Pressure-Seal Fittings:

1. Manufacturers:

a. Elkhart Products (Apolloxpress).
b. NIBCO Inc. (Press System).
c. Viega (ProPress).

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.
6. Smart Connect feature to guarantee identification of unpressed connections during the testing process.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

1. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.
2. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.
3. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.]
4. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Butt welding.
    c. Facings: Raised face.

B. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:

1. Manufacturers:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Hart Industries International, Inc.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.

2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges:

1. Manufacturers:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits:

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
3. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings:

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corporation.

2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples:

1. Manufacturers:

a. Grinnell Mechanical Products.
b. Perfection Corporation; a subsidiary of American Meter Company.
c. Precision Plumbing Products, Inc.
d. Sioux Chief Manufacturing Company, Inc.
e. Victaulic Company of America.

2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or pressure seal joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Standard weight steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or pressure seal joints.

D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Standard weight steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

E. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

F. Air-Vent Piping:

1. Inlet: Same as service where installed according to the piping manufacturer's written instructions.
2. Outlet: Type L, annealed-temper copper tubing with soldered or flared joints.

G. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed according to the piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such 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. Cut pipe to measurements established at site and work into place with forcing or springing.

C. Piping shall be installed by skilled mechanics using designated basic materials plus any required supplementary materials.

D. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Install piping to permit valve servicing.

H. Install piping at indicated slopes.

I. Install piping straight and true, free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install piping to allow application of insulation.

L. Select system components with pressure rating equal to or greater than system operating pressure.

M. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

N. 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.

O. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

P. 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.

Q. Install unions in piping**,** NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.3 PIPE GRADING

A. General: Grade each system in accordance with good established practice to avoid air pockets, to relieve liquids and vent gases. Grade uniformly between indicated elevations or at indicated slope. Slopes shown on plans shall take precedence over any listed herein.

B. Heating and Chilled Water Circulating Lines: Lay on an even slope; grade to drain at a valve at the circulating pump whenever possible; where other low points are unavoidable, provide service drains. Where horizontal mains change size, keep the tops of the coupled pipes on the same level using eccentric couplings.

C. Equipment Drains: Each line from a relief valve, air vent valve, separator or a boiler, drip pan elbow, exhaust head, heat exchanger, compression tank, receiver, pump base, air conditioning unit pan, air washer overflow and drain, evaporator pan, and similar drain shall grade down to a point of open sight discharge and/or as indicated on the drawings.

3.4 HANGERS AND SUPPORTS

A. Piping support must account for expansion and contraction, vibration, dead load of piping and its contents, and seismic-bracing requirements.

B. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

C. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Use manufacturer's recommended methods and follow all applicable codes for joining each piping system.

C. Make square cuts on all pipes using proper tools and alignment devices. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

D. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

1. Use solder joint fittings in copper tubing lines.
2. Do not anneal copper tubing and fittings.
3. Tubing shall be cut square, and burrs shall be removed. Insides of fittings and outsides of tubing shall be well cleaned with steel wool, steel brushes, and/or emery cloth before assembly.
4. Installation shall be made by skilled mechanics in accordance with the material manufacturer's recommendations.
5. Mitering of joints for elbows and notching of straight runs for tees will not be permitted.
6. All joints shall be made with solid string or wire solder. Fluxes shall be non-corrosive pastes of the proper type. Solder shall be lead free. No cored solder will be permitted.

F. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

1. All joints shall be fusion welded by a metallic arc or gas welding process. Pipe ends shall be beveled 37½°. All welding operations shall conform to the latest recommendations of the American Welding Society or to the applicable provisions of the Code for Pressure Piping, ANSI B31.1, latest edition, amended to date.
2. Weld rods shall be of the proper type for each application to match the line materials.

3. If the Engineer so requests, the Contractor shall have each of his welders prepare test coupons which shall be tested in an approved independent testing laboratory and any defects found shall be cause for dismissal of the welder from the project. All cost of such tests shall be borne by the Contractor.
4. Branch takeoffs not larger than 2/3 of the main may be made using shaped nipples, weldolets, or threadolets to match branch line fabrication methods.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Copper Fittings

1. Use wrought copper solder joint type in all patterns and sizes available. Use long radius copper elbows wherever available and space will permit.

I. Flanges

1. At connections to flanged valves and equipment outlets in steel piping systems using welding neck, slip on welding flanges, screwed steel, or cast iron companion flanges.

   a. It will be permissible to use cast iron flanged fittings at connections to equipment items.

2. In grooved end piping systems use matching flanged adapter nipples.
3. In copper lines use brass flanges.
4. Connecting flanges shall have matching flat or raised faces. Faces shall be free of imperfections that would prevent proper seating.
5. Tighten bolts uniformly all around to prevent any stress.

J. Gaskets

1. Manufactured from proper materials as with performance and materials described in Division 23 "Common Work Results for HVAC", unless otherwise indicated. Full-faced type for flat-faced flanges and ring type for raised-faced flanges.

   a. Water Lines: Red rubber sheeting.
   b. Steam and Condensate Return Lines: Non-asbestos sheeting.
   c. Dielectric Flanges: As provided with the flanges.
   d. Other Lines: As recommended for the duty.

K. Pressure-Sealed Joints:

1. Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.
2. Sealing element shall be verified for the intended use.
3. Tube ends shall be cut on a right angle (square) to the tube.
4. Tube ends shall be reamed and chamfered, all grease, oil or dirt shall be removed from the tube end with a clean rag.
5. Visually examine the fitting sealing element to ensure there is no damage, and it is properly seated into the fitting.
6. Utilizing an Insertion Depth Inspection Gauge mark the tube wall, with a felt tip pen, at the appropriate location, or insert the tube fully into the fitting and mark the tube wall at the face of the fitting.

7. Always examine the tube to ensure it is fully inserted into the fitting prior to pressing the joint.
8. Pressure-seal fittings ½-inch thru 4-inch shall be joined using appropriate sized tools.
9. Pressure-seal fittings shall be installed according to the most current edition of the Manufacturer's installation guidelines.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

E. For hydronic connections less than NPS 2-1/2", provide one of the following, but not both:

1. Flexible connectors.
2. Three 90-degree offsets in close proximity of the connection.

3.7 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Procedures in subparagraphs below are paraphrased from ASME B31.9.
2. Test piping prior to backfilling, concealing, insulating or painting; isolate pressure sensitive equipment from tests.

   a. Test portions as required by construction schedule. When previously tested sections are expanded, retest at connections.
   b. Test new portions as required by construction schedule; test new connections into existing lines.

3. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Air may be substituted as a testing medium instead of water. Refrigerant lines shall be leak tested with air unless otherwise indicated.

4. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
5. Isolate expansion tanks and determine that hydronic system is full of water.
6. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
7. After hydrostatic test pressure has been applied for at least 4 hours, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components and repeat hydrostatic test until there are no leaks.
8. Prepare written report of testing. All test results shall be submitted to the Owner and Architect. Provide all tests required by acceptable codes.
9. Furnish all compressed air, vacuum and water pumps; tanks of compressed air, nitrogen, carbon dioxide, refrigerant, gauges, plugs, seals, etc., as required to obtain, maintain and measure pressures during tests.
10. Pressure test all systems per governing codes, to a minimum of 1.5 times the working pressure, or the following table, whichever is greater:

| Piping System | Test Pressure (psig) |
|---|---|
| High Pressure Steam (above 15 psig) | 200 |
| Low Pressure Steam (15 psig and less) | 100 |
| Gravity Steam Condensate Returns | 100 |
| Pumped Steam Condensate Return | 200 |
| Heating, Chilled, and Condenser Water | 150 |
| Refrigerant | 450 |

11. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

## 3.8 REPAIRS

A. Effect repairs as recommended by the manufacturer of the pipe and fittings materials; replace any defective materials. When procedures involve additional work on a joint and they fail, remake the joint. Repair operations shall include:

1. Screwed Joints: Additionally tighten.
2. Caulked Joints: Additionally caulk.
3. Welded Joints: Chip out old weld metal and re-weld.
4. Compression Joints: Re-clean; replace seal, compression rings, couplings, etc.
5. Mechanical Joints: Re-clean; additionally tighten.
6. Soldered or Brazed Joints: Remake joint, no additional soldering or brazing allowed.

3.9 CLEANING

A. Clean all new piping systems and components prior to putting into service.

B. Heating Water Systems: Fill the entire system with a solution consisting of one pound of caustic soda or 3 pounds of trisodium phosphate per 100 gallons of water; heat to 150°F and circulate for 48 hours over at least a 3 day period; drain, flush with fresh water and refill with fresh water to which adequate amounts of suitable chemicals have been added.

C. Chilled and Condenser Water Systems: Fill the entire system with a solution consisting of one pound caustic soda or 3 pound of trisodium phosphate per 100 gallons of water; circulate for 60 hours over at least a 5 day period; drain, flush with fresh water and refill with fresh water to which adequate amounts of suitable chemicals have been added.

D. Waste and Drain Lines: Swab out lines; flush with fresh water.

E. Repetition: Repeat the above procedures until all parts of each piping system are thoroughly cleaned of all foreign materials.

END OF SECTION 232113

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. Section includes special-duty valves and specialties for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Condensate-drain piping.
4. Air-vent piping.
5. Safety-valve-inlet and -outlet piping.

B. Related Sections include the following:

1. Division 23 Section "Expansion Fittings and Loops for HVAC Piping" for expansion fittings.
2. Division 23 Section "General-Duty Valves for HVAC Piping" for valves and accessories for piping.
3. Division 23 Section "HVAC Insulation – Duct, Equipment, and Piping" for pipe saddles at pipe hangers.
4. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for seismic and wind restraint requirements.

## 1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air-control devices.
3. Hydronic specialties.

B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

## 1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

## 1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding 150 psig minimum working pressure at the temperature listed below, unless otherwise indicated:

1. Hot-Water Heating Piping: 200 deg F.
2. Chilled-Water Piping: 200 deg F.
3. Condensate-Drain Piping: 200 deg F.
4. Air-Vent Piping: 200 deg F.
5. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers:

a. Armstrong Pumps, Inc.
b. Bell & Gossett Domestic Pump; a division of ITT Industries.
c. Flow Design Inc.
d. Griswold Controls.
e. Taco.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Manufacturers:

a. Armstrong Pumps, Inc.
b. Bell & Gossett Domestic Pump; a division of ITT Industries.
c. Flow Design Inc.
d. Grinnell Mechanical Products.
e. Griswold Controls.
f. Taco.
g. Tour & Andersson; available through Victaulic Company of America.

2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Seat: PTFE.
6. End Connections: Flanged or grooved.
7. meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

E. Diaphragm-Operated Safety Valves: ASME labeled.

1. Manufacturers:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett Domestic Pump; a division of ITT Industries.
d. Conbraco Industries, Inc.
e. Spence Engineering Company, Inc.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Seat: Brass.
4. Stem Seals: EPDM O-rings.
5. Diaphragm: EPT.
6. Wetted, Internal Work Parts: Brass and rubber.
7. Inlet Strainer: Stainless steel, removable without system shutdown.
8. Valve Seat and Stem: Noncorrosive.
9. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Automatic Flow-Control Valves:

1. Manufacturers:

a. Flow Design Inc.
b. Griswold Controls.
c. Nexus.
d. NuTech.

2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
4. Combination Assemblies: Include bonze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Minimum Operating Temperature: 200 deg F.

2.3 AIR-CONTROL DEVICES

A. Manufacturers:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.
5. Spirotherm.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. Minimum Simultaneous Operating Point: 150 psig at 225 deg F.

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. Minimum Simultaneous Operating Point: 150 psig at 240 deg F.

2.4 HYDRONIC PIPING SPECIALTIES

A. Strainer Perforations: All strainers shall be stainless steel and sized based on the service and installed pipe size as indicated by the table below, unless indicated otherwise.

| SERVICE DUTY | PIPE SIZE (NPS) | STRAINER BASKET PERFORATION SIZE (in) |
|---|---|---|
| Chilled and Hot Water | 1/4" to 2" | 0.033 |
| | 2-1/2" to 4" | 0.057 |
| | | |
| Condenser Water | 1/4" to 2" | 0.020 |
| | 2-1/2" to 4" | 0.045 |
| | | |

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger. Grooved connections are also acceptable.
3. CWP Rating: 125 psig.

C. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

B. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. All valves shall be installed with stems in vertical position, unless otherwise indicated. If not possible, stems may be installed 45° off vertical position where allowed by manufacturer.

G. Install unions in piping**,** NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

H. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

I. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Select system components with pressure rating equal to or greater than system operating pressure.

B. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

C. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

D. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

E. Install air separators on chilled and heating water systems.

F. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

G. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

H. Install expansion tanks on the floor or suspended as indicated. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 232116

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg. Metal ducts include the following:

1. Rectangular ducts and fittings.
2. Single-wall, round, and flat-oval spiral-seam ducts and formed fittings.
3. Double-wall, round, and flat-oval spiral-seam ducts and formed fittings.
4. Duct liner.

B. Related Sections include the following:

1. Division 23 Section "Nonmetal Ducts" for fibrous-glass ducts, thermoset FRP ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
3. Division 23 Section "Breechings, Chimneys, and Stacks".
4. Division 23 Section "Hangers and Supports for HVAC Piping and Equipment".
5. Division 23 Section "Air Duct Accessories" for fire and smoke
6. Division 07 Section "Penetration Firestopping" for firestopping materials and installation methods.

## 1.2 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

## 1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings: CAD-generated and drawn to same scale as contract drawings, minimum 1/8 inch equals 1 foot scale. Show fabrication and installation details for metal ducts.

1. Shop drawings required for all areas of the building
2. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
3. Duct sizes shown on the drawings are net free area and indicate design intent. When obstructions occur within the duct from motorized actuators, damper frames, duct liner, etc., the duct size shall be increased to preserve free area design intent. Duct layout indicating the following:

   a. Sizes and pressure classes.

b. Elevations of top and bottom of ducts.
c. Dimensions of main duct runs from building grid lines.
d. Fittings.
e. Duct accessories, including access doors and panels.
f. Notes indicating deviations from design intent for detailed review by Engineer.

4. Equipment installation based on equipment being used on Project.
5. Submit the following with the initial shop drawing package:

a. Reinforcement and spacing.
b. Seam and joint construction.
c. Penetrations through fire-rated and other partitions.
d. Hangers and supports, including methods for duct and building attachment and vibration isolation.
e. Dampers

1) Locations of fire-smoke dampers.
2) Locations of motorized control dampers.
3) Indication of location, size, and quantity of damper actuators in the air stream.
4) Location of damper actuator access for maintenance and inspection.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings are required for all areas and shall remain on site. Coordinate with all trades.

B. Welding certificates.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports, AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
3. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."

1.6 DELIVERY, STORAGE, AND HANDLING

A. After fabrication and before the ductwork is installed it shall be "wiped clean" and "heat-shrink wrapped" or some other method of wrap for maintaining a clean ductwork system during delivery to and storage at the jobsite.

B. Deliver ducts with all openings protected and sealed. Maintain covered openings through shipping, storage, and handling to prevent entrance of dirt, debris, and moisture.

C. The area provided for duct storage at the jobsite shall be clean, dry and exposure to dust minimized.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view and minimum 24 gage thickness.

C. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.

D. Stainless Steel: ASTM A 480/A 480M, Type 316 or 304, and having a No. 2D finish for concealed ducts and for exposed ducts.

E. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

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.

2.2 DUCT FIRE WRAP

A. Fire wrap: An assembly providing at least a 2-hour fire rating for sheet metal ducts.

B. Manufacturers:

1. Pabco.
2. Unifrax: FyreWrap.

C. Quality Assurance: Comply with NFPA 96 and U.L. standards.

D. Where permitted by local codes, the products above may be a substitute for a 2-hour fire rated gypsum board covering.

2.3 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Joint and Seam Tape: 2 inches wide; glass-fiber-reinforced fabric.

C. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

D. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

E. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.

F. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

G. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.4 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
2. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

2.5 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:

   a. Ductmate Industries, Inc.
   b. Nexus Inc.
   c. Ward Industries, Inc.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, metal cleat, and gasket details.

1. Manufacturers:

   a. Ductmate Industries, Inc.
   b. Lockformer.

2. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.6 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

1. Manufacturers:

   a. McGill AirFlow Corporation.
   b. SEMCO Incorporated.
   c. Lewis & Lambert
   d. Gowco, Inc.
   e. Spiramir
   f. National Duct Systems

C. Flat-Oval, Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

1. Manufacturers:

   a. McGill AirFlow Corporation.
   b. SEMCO Incorporated.
   c. Lewis & Lambert
   d. Gowco, Inc.
   e. Spiramir
   f. National Duct Systems

D. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
4. Flat-Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.

    a. Manufacturers:

        1) Ductmate Industries, Inc.
        2) McGill AirFlow Corporation.
        3) SEMCO Incorporated.

E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

F. Diverging-Flow Fittings: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

G. Fabricate elbows using die-formed, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:

    a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
    b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
    c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
    d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.

3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:

    a. Ducts 3 to 26 Inches in Diameter: 0.034 inch.
    b. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
    c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
    d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.

4. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only.
5. Round Elbows Larger Than 9 Inches in Diameter: Fabricate pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows.
6. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.

7. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.

H. PVC-Coated Elbows and Fittings: Fabricate elbows and fittings as follows:

1. Round Elbows 4 to 8 Inches in Diameter: Two piece, die stamped, with longitudinal seams spot welded, bonded, and painted with PVC aerosol spray.
2. Round Elbows 9 to 26 Inches in Diameter: Standing-seam construction.
3. Round Elbows 28 to 60 Inches in Diameter: Standard welded construction.
4. Other Fittings: Welded joints.
5. Couplings: Slip-joint construction with a minimum 2-inch insertion length.

2.7 DOUBLE-WALL DUCT AND FITTING FABRICATION

A. Manufacturers:

1. McGill AirFlow Corporation.
2. SEMCO Incorporated.

B. Ducts: Fabricate double-wall (insulated) ducts with an outer shell and an inner duct. Dimensions indicated are for inner ducts.

1. Outer Shell: Base metal thickness on outer-shell dimensions. Fabricate outer-shell lengths 2 inches longer than inner duct and insulation and in metal thickness specified for single-wall duct.

2. Insulation: 1-inch-thick fibrous glass, unless otherwise indicated. Terminate insulation where double-wall duct connects to single-wall duct or uninsulated components and reduce outer shell diameter to inner duct diameter.

a. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.

3. Solid Inner Ducts: Use the following sheet metal thicknesses and seam construction:

a. Ducts 3 to 8 Inches in Diameter: 0.019 inch with standard spiral-seam construction.
b. Ducts 9 to 42 Inches in Diameter: 0.019 inch with single-rib spiral-seam construction.
c. Ducts 44 to 60 Inches in Diameter: 0.022 inch with single-rib spiral-seam construction.
d. Ducts 62 to 88 Inches in Diameter: 0.034 inch with standard spiral-seam construction.

4. Perforated Inner Ducts: Fabricate with 0.028-inch-0.7-mm- thick sheet metal having 3/32-inch-diameter perforations, with overall open area of 23 percent.
5. Maintain concentricity of inner duct to outer shell by mechanical means. Prevent dislocation of insulation by mechanical means.

C. Fittings: Fabricate double-wall (insulated) fittings with an outer shell and an inner duct.

1. Solid Inner Ducts: Use the following sheet metal thicknesses:

a. Ducts 3 to 34 Inches in Diameter: 0.028 inch.
b. Ducts 35 to 58 Inches in Diameter: 0.034 inch.
c. Ducts 60 to 88 Inches in Diameter: 0.040 inch.

2. Perforated Inner Ducts: Fabricate with 0.028-inch-thick sheet metal having 3/32-inch-diameter perforations, with overall open area of 23 percent.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Primary Supply Ducts (before Air Terminal Units): 4-inch wg.
2. Secondary Supply Ducts (after Air Terminal Units): 2-inch wg.
3. Return Ducts (Negative Pressure): 2-inch wg.
4. Exhaust Ducts (Negative Pressure): 3-inch wg.
5. All other ducts: 2.5 inch wg (750 Pa), positive or negative based on service.

B. All ducts shall be galvanized steel except as follows, unless otherwise indicated:

1. Range Hood Exhaust Ducts: Comply with NFPA 96.

a. Concealed: Carbon-steel sheet.
b. Exposed: Type 304, stainless steel with finish to match kitchen equipment and range hood.
c. Fully weld all seams and joints.

2. Wet Exhaust Service Ducts:

a. Construction:

1) Type 304, stainless steel with finish to match kitchen equipment and range hood. Fully weld all seams and joints.
2) Aluminum, soldered with seams and laps arranged on top of duct.

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install ducts with fewest possible joints.

C. Install fabricated fittings for changes in directions, size, and shape and for connections.

D. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws.

E. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Provide break away flange for all stainless steel ductwork at fire/smoke damper interfaces. Install stainless steel drain pans extending beyond in all directions with automatic condensate pumps and piping to nearest code approved drain at break away.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant.

O. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

P. Paint interiors of metal ducts that do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections. Painting not required for ducts serving mechanical, electrical and data rooms.

Q. Provide temperature range for duct mounted thermometer dials: Minus 40 to plus 110 deg F, with 2-degree scale divisions.

## 3.3 INSTALLATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with complete adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liner with longitudinal joints in rectangular ducts, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

G. 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.

H. 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:

1. Fan discharges.
2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.

3.4 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for ducts, per Seal Class 'A'.

B. Seal ducts before external insulation is applied.

3.5 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D. Install concrete inserts before placing concrete.

E. Support Ducts per SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for ducts.

F. Do not use powder-actuated concrete fasteners

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 FIELD QUALITY CONTROL

A. The leak testing shall be observed by the General Contractor's representative and the Owner's representative. Provide 48 hours notification of such tests.

B. All ducts shall be tested per Banner Standards. Submit a written report. The contractor is required to maintain on-site a set of ductwork prints that are shaded in different colors to show the duct section isolated for each test. Also the Contractor shall indicate on the print the date each section of duct was tested and the final percent leakage rate measured for each test section.

1. All ductwork shall be pressure tested in accordance with SMACNA for leakage and meet the leakage requirements of SMACNA for the duct pressure classification.
2. All ductwork (Supply, return and exhaust) shall be leakage tested in its normal operating state (positive or negative) at 1.5 times design pressure. Leakage of the ductwork system shall not exceed 1% of the total system volumetric flow rate.

C. If any duct section fails the leakage test, the contractor shall repair the leakage and re-perform the leakage test.

D. The leakage test shall be performed using a kit as furnished by United McGill Corp. or approved equal and shall include the following components:

1. Blower
2. Two manometers or U-tubes
3. Calibrated orifice tube

E. The leakage test procedure is as follows:

1. Carefully seal off all openings (except one for connecting the test equipment) to the duct run-out section to be tested.
2. Connect the downstream end of the orifice tube to the duct system using a piece of flexible tubing.
3. Connect one manometer to the static taps on the tube to read orifice differential pressure. Connect the other manometer to a 5/16" tap in the duct at least one foot from the blower connection to read test static pressure.
4. Attach the blower to the orifice tube and block off the inlet to prevent over pressurizing a tight system.
5. Start the blower and slowly open the inlet until the desired test static pressure is reached. Let the blower run for at least one minute to insure a steady state.
6. At this point, the air flowing through the orifice tube is going into the duct system and is equal to the amount leaking out. This leakage rate can be read from the calibration chart on the orifice tube. This measured cfm is used to determine the leakage percent.
7. If the duct system is too large and the allowable leakage is greater than the capacity of the blower, the system shall be tested in several sections and the results added together.

## 3.8 DUCT CLEANLINESS AND DUCT CLEANING

1. DUCT CLEANLINESS

a. It is the intent to provide an installation of a ductwork system that appears to be visibly clean.
b. A visual inspection of porous and non-porous ductwork components must be monitored by the Contractor to ensure that the system is visibly clean. The system has excessive dust or debris when an accumulation of particles can be observed in the ductwork. An interior surface is considered visibly clean when it is free from non-adhered substances and debris.
c. Cleanliness verification shall be performed after the ductwork system has been "wiped clean" and prior to the application of any piece of equipment or component being used in operation.

d. If air handling units are operated without the pre-filters and the final filters in place, the ductwork shall be replaced or vacuumed per Article B "Cleaning New Systems" below.

2. Condition of new ductwork shall include the following measures:

   a. Any internal exposed mastic sealant to be removed.
   b. The light coating of oil on machine formed sheet metal ductwork is to be removed.
   c. The discoloration marks from the plasma cutting process must be removed.
   d. Before installation of the individual duct sections they are to be visually inspected for dust and/or debris, and wiped clean, if necessary.
   e. After the ductwork has been installed, the cleanliness procedure shall be to temporarily cover the open ends of the ductwork to prevent dust and debris of finding its way to the system.
   f. If vacuuming is required to adequately clean the ductwork, the vacuum cleaner must be HEPA filtered and capable of achieving a minimum of 40 inches of water gage. The vacuum should be fitted with a 2.5" round nylon brush attached to a 1.5" diameter vacuum hose.

3. Conditions of existing ductwork and equipment within the systems that serve the renovated areas shall be visually inspected for dust and debris.

   a. If dust and/or debris is observed within the existing system, it shall be cleaned to remove all visual dust and debris. This process may include the addition of access doors to facilitate the "wiping" and/or "vacuuming" of the ductwork systems.
   b. The system cleanliness procedures shall be adhered to during the construction process of the renovations.
   c. New ductwork required for additions within the existing renovated area shall follow the procedures addressed above for the new ductwork.
   d. If vacuuming is required to adequately clean the ductwork, the vacuum cleaner must be HEPA filtered and capable of achieving a minimum of 40 inches of water gage. The vacuum should be fitted with a 2.5" round nylon brush attached to a 1.5" diameter vacuum hose.

B. CLEANING NEW SYSTEMS

1. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.
2. Use service openings, as required, for physical and mechanical entry and for inspection.

   a. Create other openings to comply with duct standards.
   b. Disconnect flexible ducts as needed for cleaning and inspection.
   c. Remove and reinstall ceiling sections to gain access during the cleaning process.

3. Vent vacuuming system to the outside. Include HEPA filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.
4. Clean the following metal duct systems by removing surface contaminants and deposits:

   a. Air outlets and inlets (registers, grilles, and diffusers).
   b. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

c. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
d. Coils and related components.
e. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
f. Supply-air ducts, dampers, actuators, and turning vanes.

5. Mechanical Cleaning Methodology:

a. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
b. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
c. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
d. Do not permit fibrous-glass duct liner to get wet. Remove and replace wet duct liner.
e. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6. Cleanliness Verification:

a. Visually inspect metal ducts for contaminants.
b. Where contaminants are discovered, re-clean and reinspect ducts.

C. CLEANING EXISTING SYSTEMS

1. Use service openings, as required, for physical and mechanical entry and for inspection.

a. Use existing service openings where possible.
b. Create other openings to comply with duct standards.
c. Disconnect flexible ducts as needed for cleaning and inspection.
d. Reseal rigid fiberglass duct systems according to NAIMA recommended practices.
e. Remove and reinstall ceiling sections to gain access during the cleaning process.

2. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.
3. Particulate Collection and Odor Control:

a. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or larger) particles.
b. When venting vacuuming system to the outside, use filtration to contain debris removed from HVAC system, and locate exhaust down wind and away from air intakes and other points of entry into building.

4. Clean the following metal duct systems by removing surface contaminants and deposits:

a. Air outlets and inlets (registers, grilles, and diffusers).
b. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

c. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
d. Coils and related components.
e. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
f. Supply-air ducts, dampers, actuators, and turning vanes.
g. Dedicated exhaust and ventilation components and makeup air systems.

5. Mechanical Cleaning Methodology:

a. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
b. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
c. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
d. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
e. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
f. Provide operative drainage system for washdown procedures.
g. Biocidal Agents and Coatings: Apply biocidal agents if fungus is present. Apply biocidal agents according to manufacturer's written instructions after removal of surface deposits and debris.

6. Cleanliness Verification:

a. Verify cleanliness after mechanical cleaning and before application of treatment, including biocidal agents and protective coatings.
b. Visually inspect metal ducts for contaminants.
c. Where contaminants are discovered, re-clean and reinspect ducts.

7. Gravimetric Analysis: At discretion and expense of Owner, sections of metal duct system, chosen randomly by Owner, may be tested for cleanliness according to NADCA vacuum test gravimetric analysis.

a. If analysis determines that levels of debris are equal to or lower than suitable levels, system shall have passed cleanliness verification.
b. If analysis determines that levels of debris exceed suitable levels, system cleanliness verification will have failed and metal duct system shall be re-cleaned and re-verified.

8. Verification of Coil Cleaning: Cleaning must restore coil pressure drop to within 10 percent of pressure drop measured when coil was first installed. If original pressure drop is not known, coil will be considered clean only if it is free of foreign matter and chemical residue, based on thorough visual inspection.

END OF SECTION

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Combination fire and smoke dampers.
6. Duct silencers.
7. Turning vanes.
8. Duct-mounting access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.

B. Related Sections include the following:

1. Division 23 Section "Instrumentation and Control for HVAC" for electric and pneumatic damper actuators.
2. Division 23 Section "Metal Ducts" for duct construction and fittings.
3. Division 28 Section "Fire Detection and Alarm" for duct-mounting fire and smoke detectors.

## 1.2 DEFINITIONS

A. Low Leakage: Class 1A as defined by AMCA Standard 511, equating to less than 3cfm/ft2of damper area, at differential pressure of 1-inch wgess than 8cfm/ft2of damper area, at differential pressure of 4-inch wg when damper is being held by torque of 50 in. x lbf; when tested according to AMCA 500D.

## 1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Ceiling fire dampers.
6. Smoke dampers.
7. Combination fire and smoke dampers.
8. Duct silencers.
9. Turning vanes.
10. Duct-mounting access doors.
11. Flexible connectors.
12. Flexible ducts.

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. Special fittings.
2. Manual-volume damper installations.
3. Motorized-control damper installations.
4. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
5. Identify duct velocity and pressure class of duct system dampers are installed in.

6. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent, rounding up, for each type of amount installed with a minimum of one.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

D. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

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.

2.2 BACKDRAFT DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. Duro Dyne Corp.
4. Greenheck.
5. Loren Cook.
6. Penn Ventilation Company, Inc.
7. Pottoroff.
8. Prefco Products, Inc.
9. Ruskin Company.
10. Vent Products Company, Inc.

B. Description: Multiple or single-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Frame: Galvanized sheet steel, with welded corners and mounting flange.

D. Blades: 0.050-inch-thick aluminum sheet.

E. Blade Seals: Neoprene.

F. Blade Axles: Nonferrous.

G. Tie Bars and Brackets: Aluminum.

H. Return Spring: Adjustable tension.

2.3 VOLUME DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. Flexmaster U.S.A., Inc.
4. McGill AirFlow Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. National Controlled Air.
8. Penn Ventilation Company, Inc.
9. Pottoroff.
10. Ruskin Company.
11. Vent Products Company, Inc.
12. Young Regulator Company.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
2. Dampers integral to building envelope shall be AMCA 511 Class 1 rated, minimum.

C. Duct Dampers.

1. Standard Volume:

a. Multiple- or single-blade, parallel- or opposed-blade design, AMCA 511 Class 2 rated, with linkage outside airstream, and suitable for horizontal or vertical applications. Blade and frame materials shall match.
b. Steel:

1) Frames: Hat-shaped, galvanized sheet steel channels, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2) Roll-Formed Blades: Galvanized sheet steel.

c. Aluminum

1) Frames: Hat-shaped, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
2) Roll-Formed Blades: 0.10-inch-thick aluminum sheet.
3) Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

d. Blade Axles: Galvanized steel.
e. Bearings: Oil-impregnated bronze, molded synthetic, or stainless-steel sleeve.
f. Tie Bars and Brackets: Aluminum.

2. Low-Leakage Volume:

a. Multiple-blade, parallel- or opposed-blade design as indicated, AMCA 511 Class 1A rated, with linkage outside airstream, and suitable for horizontal or vertical applications. Blade and frame materials shall match.
b. Steel:

1) Frames: Hat, U-, or angle-shaped, galvanized sheet steel channels, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2) Roll-Formed Blades: 0.064-inch-thick, galvanized sheet steel.

c. Aluminum:

1) Frames: Hat, U-, or angle-shaped, aluminum sheet channels; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2) Roll-Formed Blades: 0.10-inch-thick aluminum sheet.
3) Extruded Blades: 0.050-inch-thick extruded aluminum.

d. Blade Axles: Galvanized steel.
e. Bearings: Oil-impregnated bronze or stainless-steel sleeve thrust or ball.
f. Blade Seals: Vinyl or Neoprene.
g. Jamb Seals: Cambered stainless steel.
h. Tie Bars and Brackets: Galvanized steel.

3. Remote Mounted:

a. Rack-and-pinion controller fabricated from minimum 14 gage galvanized steel with graduations for positive locking control.
b. Control cable shall be .054" stainless steel in 1/16" flexible galvanized casing.

D. Duct Tap-Offs

1. Duct tap offs from rectangular or round duct are round, conical connector, with spin-in or twist-in collar, and integral damper. Include bead from using mechanical strap.
2. Side taps, consisting of an eccentric wedge pointing into the flow narrowing to a round duct are also acceptable.
3. Construction materials and pressure class shall identical to the attached duct system.

E. Jackshaft: Pipe matching linkage material rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware: 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. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.4 MOTORIZED CONTROL DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. Duro Dyne Corp.
4. Greenheck.
5. McGill AirFlow Corporation.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. National Controlled Air.
9. Pottoroff.
10. Penn Ventilation Company, Inc.
11. Ruskin Company.
12. Vent Products Company, Inc.

B. General Description: Class 1A, AMCA 511, parallel or opposed-blade airfoil design; galvanized-steel frames with holes for duct mounting; galvanized-steel damper blades with maximum blade width of 8 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. Provide parallel- or opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for low leakage.

2.5 FIRE DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. Greenheck.
3. McGill AirFlow Corporation.
4. METALAIRE, Inc.
5. Nailor Industries Inc.
6. National Controlled Air.
7. Penn Ventilation Company, Inc.
8. Pottoroff.
9. Prefco Products, Inc.
10. Ruskin Company.
11. Vent Products Company, Inc.
12. Ward Industries, Inc.

B. Fire dampers shall be labeled according to UL 555, Class 1.

C. Fire Rating: 1-1/2 and 3 hours.

1. Type 304, stainless-steel dampers are also available for corrosive atmospheres.

D. Frame: fabricated with roll-formed galvanized steel; with mitered and interlocking corners.

1. Provide multiple-blade type for dynamic applications.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

F. Blades: Roll-formed, interlocking, galvanized sheet steel. In place of interlocking blades, use full-length, galvanized-steel blade connectors.

G. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

H. Resets:

1. Fusible Links: Replaceable, 165 deg F (74 deg C).

2.6 SMOKE AND COMBINATION FIRE / SMOKE DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. Greenheck.
3. Nailor Industries Inc.
4. National Controlled Air.
5. Penn Ventilation Company, Inc.
6. Pottoroff.
7. Ruskin Company.

B. General Description: Labeled according to UL 555S, Class 1. Combination fire and smoke dampers shall be labeled according to UL 555 for 1-1/2-hour rating.

C. Resets:

1. Automatic.

D. Frame and Blades: 0.064-inch-thick, galvanized sheet steel.

E. Mounting Sleeve: Factory-installed galvanized sheet steel; length to suit wall or floor application.

F. Damper Motors: Modulating and two-position action.

1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
3. 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.
4. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at 10 degrees lower than ASHRAE 99.6% Heating DB.
5. 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.
6. Electrical Connection: 115 V, single phase, 60 Hz.

## 2.7 DUCT SILENCERS

A. Manufacturers:

1. Dynasonics.
2. I.A.C.
3. Industrial Noise Control, Inc.
4. McGill AirFlow Corporation.
5. Ruskin Company.
6. SEMCO.
7. Vibro-Acoustics.

B. General Description: Factory-fabricated and -tested, round or rectangular silencers with performance characteristics and physical requirements as indicated. Gage and material of casing shall be no less than the requirements of the system served.

C. Fire Performance: Adhesives, sealants, packing materials, and accessory materials shall have fire ratings not exceeding 25 for flame-spread index and 50 for smoke-developed index when tested according to ASTM E 84.

D. Rectangular Units: Fabricate casings with solid galvanized sheet metal for outer casing and ASTM A 653/A 653M, G90, perforated galvanized sheet metal for inner casing.

E. Round Units:

1. Outer Casings:

a. ASTM A 653/A 653M, G90, galvanized sheet steel.

2. Interior Casing, Partitions, and Baffles:

a. ASTM A 653/A 653M, G90, galvanized sheet steel.
b. At least 0.034 inch thick and designed for minimum aerodynamic losses.

F. Sheet Metal Perforations: 1/8-inch diameter for inner casing and baffle sheet metal.

G. Fill Material: Inert, moisture proof, and vermin-proof material, packed under not less than 5 percent compression.

1. Erosion Barrier:

a. Polymer or Tedlar bag enclosing fill and heat-sealed before assembly.
b. Mylar layer attached with adhesive between fill and airstream.

H. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations.

1. Do not use nuts, bolts, or sheet metal screws for unit assemblies.
2. Lock form and seal or continuously weld joints.
3. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
4. Reinforcement: Cross or trapeze angles for rigid suspension.

I. Source Quality Control:

1. Acoustic Performance: Test according to ASTM E 477.
2. Record acoustic ratings, including dynamic insertion loss and self-noise power levels with an airflow of at least 2000-fpm face velocity.
3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

## 2.8 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch-wide, single or double-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.

1. Manufacturers:

   a. Ductmate Industries, Inc.
   b. Duro Dyne Corp.
   c. Dynasonics.
   d. I.A.C.
   e. METALAIRE, Inc.
   f. SEMCO.
   g. Ward Industries, Inc.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill, with Mylar or Tedlar wrap around fill.

D. Acoustic Elbows: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill, with Mylar or Tedlar wrap around fill.

2.9 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Manufacturers:

   a. American Warming and Ventilating.
   b. Ductmate Industries, Inc.
   c. Flexmaster U.S.A., Inc.
   d. Greenheck.
   e. McGill AirFlow Corporation.
   f. Nailor Industries Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

   a. Less Than 12 Inches Square: Secure with two sash locks.
   b. Up to 18 Inches Square: Two hinges and two sash locks.
   c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
   d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.

1. Manufacturers:

   a. Ductmate Industries, Inc.
   b. Flexmaster U.S.A., Inc.

2. Frame: Galvanized sheet steel, with spin-in notched frame.

D. Pressure Relief Access Door: Single or double wall and duct mounting; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated, latches, and retaining chain.

1. Manufacturers:

a. American Warming and Ventilating.
b. Ductmate Industries, Inc.
c. Greenheck.
d. KEES, Inc.
e. McGill AirFlow Corporation.
f. Nexus PDQ.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

E. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

F. Insulation: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with NFPA 90A & 90B.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 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. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. 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.

F. 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.

G. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd..
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

2.11 FLEXIBLE DUCTS

A. Manufacturers:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow Corporation.
3. Thermaflex.
4. Wiremold.

B. Noninsulated Flexible Ducts: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.

1. Pressure Rating:4-inch wg positive and 0.5-inch wg negative.
2. Minimum Air Velocity Rating: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.

C. Insulated Flexible Ducts: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation with a minimum value of R-6; polyethylene or aluminized vapor barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Minimum Air Velocity Rating: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.

D. Metal Lined Insulated Flexible Ducts: UL 181, Class 1, Triple locked aluminum inner core; fibrous glass insulation with a minimum value of R-6.

1. Pressure Rating: 6-inch wg (1500 Pa) positive and 2-inch wg (500 Pa) negative.
2. Minimum Air Velocity Rating: 4000 fpm.
3. Temperature Range: Minus 20 to plus 250 deg FInsulated Fabric Ducts: UL 181, Class 1, with Chlorinated Polyethylene (CPE) inner core supported by helical wound galvanized steel; fibrous-glass insulation with a minimum R-6 value.
4. Pressure Rating: 6-inch wg (1500 Pa) positive and 2-inch wg (500 Pa) negative.
5. Minimum Air Velocity Rating: 4000 fpm.
6. Temperature Range: Minus 20 to plus 250 deg FFlexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action or Nylon strap, in sizes 3 through 18 inches to suit duct size.

2.12 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 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

B. Where damper actuators are located in the air stream, increase duct free area to maintain design intent.

C. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

D. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

F. Install duct test holes where indicated and required for testing and balancing purposes.

G. Install remote dampers a minimum of 5 feet, or two duct diameters, whichever is greater, before air device.

H. Remote dampers shall include controller box as approved by architect.

I. Provide test holes at fan inlets and outlets and elsewhere as indicated.

J. Install fire and smoke dampers, with reset operators or fusible links, according to manufacturer's UL-approved written instructions.

K. Install duct silencers rigidly to ducts.

L. Install duct heaters square to duct and perpendicular to air travel. Provide disconnecting means at heater.

M. Connect duct discharge temperature sensor downstream of duct heater.

N. Connect controlling thermostat or control cable to duct heater.

O. Install turning vanes in all square elbows, except for combustion air, dryer vent, and grease duct services, unless otherwise indicated.

P. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

Q. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

R. Connect terminal units to supply ducts.

S. Connect diffusers or light troffer boots to low pressure ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

T. Do not use flexible ducts to change directions.

U. Connect flexible ducts to metal ducts with draw bands.

V. Flexible duct may only be installed above hard ceilings with direct access to all both ends of the flexible duct runs. Flexible duct shall not be installed more than 24" inside a hard ceiling edge or transition.

3.2 END SWITCH APPLICATIONS

A. Install an end switches for each damper:

1. Motorized control damper.

B. Connect each motorized control damper to the BAS.

3.3 FIRE AND FIRE/SMOKE DAMPER APPLICATIONS

1. Unless otherwise indicated, provide dampers according to the following criteria:

a. Type-A dampers

1) Pressure: up to 2 inches wg.
2) Velocity: up to 1500 ft/min.
3) Duct dimensions: greater than 14 inches, square.

b. Type-B dampers

1) Pressure: up to 8 inches wg.
2) Velocity: up to 3500 ft/min

c. Type-C dampers

1) Pressure: greater than 8 inches wg.
2) Velocity: greater than 3500 ft/min.

2. Where dampers are required at sidewall grilles, damper shall be Frame Style G for flush installation of air device.

3.4 DUCT ACCESS DOOR APPLICATIONS

A. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers, motorized dampers, and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
5. On sides of ducts where adequate clearance is available.

B. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 8 inches.
2. Two-Hand Access: 12 by 12 inches.
3. Head and Hand Access: 18 by 18 inches.
4. Head and Shoulders Access: 24 by 18 inches.
5. Body Access: 30 by 24 inches.
6. Body Plus Ladder Access: 30 by 24 inches.

C. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches in diameter.
2. Two-Hand Access: 10 inches in diameter.
3. Head and Hand Access: 12 inches in diameter.
4. Head and Shoulders Access: 18 inches in diameter.
5. Body Access: 24 inches in diameter.

D. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.5 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Centrifugal roof ventilators.
2. Utility set fans.

B. Related Sections include the following:

1. Division 07 Section "Roof Accessories" for roof curbs, equipment supports, and roof penetrations.
2. Division 23 Section "Air Duct Accessories" for flexible connectors, dampers, etc. are specified in.
3. Division 23 Section "Common Motor Requirements for HVAC" for fan motors.
4. Division 23 Section "Hangers and Supports for HVAC Piping and Equipment".
5. Division 23 Section "Identification for HVAC Piping and Equipment" for fan label requirements.
6. Division 23 Section "Instrumentation and Controls for HVAC".
7. Division 23 Section "Variable Frequency Motor Controllers".
8. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for seismic and wind restraint requirements.

## 1.2 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan performance ratings on actual Project site elevations above sea level.

B. Operating Limits: Classify according to AMCA 99.

## 1.3 ACTION SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Fan schedule, by equipment mark, with capacity selections indicating required accessories.
2. Certified fan performance curves with system operating conditions indicated.
3. Certified fan sound-power ratings.
4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
5. Material thickness and finishes, including color charts.
6. Dampers, including housings, linkages, and operators.
7. Fan speed controllers, including, but not limited to, variable speed drives.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Short-circuit current rating of equipment assembly. Rating must match the rating of the overcurrent protective device serving the assembly.

3. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
4. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Manufacturer Seismic Certification: certification that equipment, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC" including items as defined in Division 23 Section "Common Work Results for HVAC".

1.4 SIMULTANEOUS ACTION SUBMITTALS

A. HVAC Fan Product Data submittal shall be made in conjunction with action submittals required under Division 26 Section "Overcurrent Protective Device Coordination Study."

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Data to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

E. Fans shall not exceed 85% of class rating at the selection point.

F. Sound-Power Level Ratings:

1. Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data."
2. Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans."
3. Label fans with the AMCA-Certified Ratings Seal.

G. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final locations, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.9 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.10 LABELS

A. All fans shall have a firmly affixed metal nameplate recording the design air capacity, static pressure, and brake horsepower.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers:

1. Greenheck.
2. Loren Cook Company.
3. Penn Ventilation.
4. Twin City Fan & Blower.

B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

D. Fan Wheels:

1. Wheels shall be statically and dynamically balanced to grade G6.3 per ANSI S2.19.
2. Aluminum hub and wheel with backward-inclined blades.

E. Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

F. Roof Curbs:

1. Factory fabricated; galvanized steel; 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 suit roof opening and fan base.
2. Configuration: Self-flashing without a cant strip, with mounting flange.
3. Overall Height: Coordinate curb height with roofing system for minimum clearances above finished roof deck as follows:

   a. General exhaust discharge: 12 inches.

2.2 UTILITY SET FANS

A. Manufacturers:

1. Greenheck.
2. Loren Cook Company.
3. Penn Ventilation.
4. Twin City Fan & Blower.

B. Description: Direct driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

C. Housing: Fabricated of steel with side sheets fastened with a deep lock seam or welded to scroll sheets.

1. Housing Discharge Arrangement: Adjustable to eight standard positions.

D. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.

1. Blade Materials: Steel or Aluminum.
2. Blade Type: Backward inclined, forward curved, airfoil.

E. Fan Shaft:

1. Turned, ground, and polished steel; keyed to wheel hub.
2. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Shaft Bearings: Grease lubricated, self-aligning, pillow-block-type ball bearings with ABMA 9 L10 at 200,000.

G. Accessories:

1. Inlet and Outlet: Flanged.
2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
3. Access Door: Gasketed door in scroll with latch-type handles.
4. Drain Connections: NPS 3/4 threaded coupling drain connection installed at lowest point of housing.
5. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.
6. Exhaust Stack: Factory designed and manufactured for vertical discharge applications.
7. Integral Curb Cap and Inlet Box: Factory designed and manufactured to eliminate the need for straight duct diameters to fan inlet and impact performance by less than 1%. Plenum box and fan inlet access granted by adjustable quick release latches.

H. Coatings: Powder-baked enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fans level and plumb.

B. Equipment shall be supported as described in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment ".

C. Secure roof mounted fans to roof curbs with cadmium-plated hardware.

D. Install units with clearances for service and maintenance.

3.2 CONNECTIONS

A. Coordinate duct installations and specialty arrangements with schematics on Drawings and with requirements specified in duct systems.

B. Duct installation and connection requirements are specified in other Division 23Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

C. Install ducts adjacent to fans to allow service and maintenance.

D. For fans with scroll drains, install line-sized piping from drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain.

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. 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 damper linkages for proper damper operation.
6. Verify lubrication for bearings and other moving parts.
7. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
8. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
9. Replace fan and motor pulleys as required to achieve design airflow.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fans. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 233400

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Shutoff single-duct air terminal units.
2. Air valves.

B. Related Sections include the following:

1. Division 23 Section "Hydronic Piping".
2. Division 23 Section "General-Duty Valves for HVAC Piping" for valves and accessories for piping.
3. Division 23 Section "Instrumentation and Control for HVAC".

## 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

2. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
2. Wiring Diagrams: Power, signal, and control wiring.

## 1.3 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 assembly members.
2. Size and location of initial access modules for acoustic tile.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data" include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

D. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

E. Verification of Performance: Rate air terminal units according to ARI 880.

1.6 COORDINATION

A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Carrier.
2. Enviro-tec.
3. Retain selection for VRU in subparagraph below for HCA projects. VRU indicates VAV Ready Unit.
4. Johnson Controls, Inc.
5. Kreuger.
6. METALAIRE, Inc.; Metal Industries Inc.
7. Nailor Industries.
8. Phoenix Corporation.
9. Price Industries.
10. Retain selection for ZCU in subparagraph below for HCA projects. ZCU indicates Zone Control Units.
11. Siemens Industry Inc.

12. Titus.

2.2 GENERAL

A. Terminal units shall be pre-assembled with factory-installed piping and pre-commissioned, factory-installed controls.

B. Terminal units shall not exceed NC 26 at 3" w.g. per AHRI 880.

C. All terminal boxes shall be insulated, double wall type and not expose insulation media to the air stream.

D. Terminals with hydronic reheat shall implement two PID loops, one with the zone temperature as the input and the second one with the box DAT as input.

2.3 UNIT CONTROLS

A. Factory-Mounted and -Wired Controls: Electrical components including, differential pressure sensor and air flow sensing tubes, shall be mounted in NEMA 250, Type 1 control box with removable cover, mounted on side of unit and sealed from airflow. Incorporate single-point electrical connection to power source.

1. Control Transformer: Factory mounted for 24 VAC control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source. Units with fans shall also require fan start/stop relay.
2. Wiring Terminations: Fan and controls to terminal strip, and terminal lugs shall match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.
3. Disconnect Switch for Fan on Fan Powered Units: Factory-mounted, fused type.
4. Terminal unit manufacturer's primary air damper actuator and a pressure independent primary air controller.]
5. Primary air Belimo Model LM 24 damper actuator and the control manufacturer's pressure independent primary air controller.
6. Airflow sensing tubes:

   a. Sensing tubes of the multipoint, automatic averaging type shall be included in each unit inlet.
   b. Dual-duct units shall have airflow sensing tubes at the unit outlet.
   c. Airflow sensing tubes are to include 'tees' utilized as balancing taps for field adjustment of the maximum (and minimum) primary CFM, without having to remove tubes from controller.
   d. The balancing taps shall be used in conjunction with a flow chart on each terminal unit to permit readjustment of the primary air. Field readjustment shall be by means of adjustment screws.

7. A schematic drawing shall be affixed to each box indicating proper hookups for electronic thermostats.

B. DDC Controls: Bidirectional damper operators and microprocessor-based controller and room sensor shall be compatible with temperature controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:

1. Damper Actuators: 24 V, powered closed.

2. Velocity Sensors: Multipoint array with velocity sensors in all air inlets and air outlet and integral to unit.
3. Terminal Unit Controller: Pressure independent, variable-air or constant-volume controller with electronic airflow transducers factory calibrated to minimum and maximum air volumes, and having the following features:

    a. Proportional, plus integral control of room temperature.
    b. Time-proportional reheat-coil control.
    c. Occupied and unoccupied operating mode.
    d. Remote reset of airflow or temperature set points.
    e. Adjusting and monitoring with portable terminal.
    f. Communication with temperature-control system specified in Division 23 Section "Instrumentation and Control for HVAC."

2.4 HEATING COILS

A. Hot-Water: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig; and factory installed.

1. Minimum two-row coils with tube thickness not less than 0.016".
2. Coil performance shall be based on ARI 410.

B. Where indicated, boxes shall be provided with a hot water heating coil and modulating control valve.

C. Heating coils shall be removable without removing the terminal unit.

2.5 SHUTOFF SINGLE-DUCT AIR TERMINAL UNITS

A. Configuration: Variable-volume damper assembly inside unit casing with control components located inside a protective metal shroud.

B. Casing: 0.034-inch steel.

a. Casing Lining:
b. Thermal insulation equivalent in performance to 1-inch-thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with one of the flowing nonporous sheets:

    1) Foil.
    2) Metal.
    3) Mylar.
    4) Tedlar.

c. Adhesive attached, 3/4-inch-thick, polyurethane foam insulation.
d. All linings and adhesives shall comply with the following standards:

    1) ASTM E 84 for Flame and Smoke, 25/50.
    2) ASTM C 665 for Fungi Resistance.
    3) UL 181 for Air Erosion and Mold Growth and Humidity.
    4) UL 723 for Flame and Smoke, 25/50.

2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.

4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket.

C. Regulator Assembly: Extruded-aluminum or galvanized-steel components; key damper blades onto shaft with nylon-fitted pivot points located inside unit casing.

1. Automatic Flow-Control Assembly: Combined spring rates shall be matched for each volume-regulator size with machined dashpot for stable operation.
2. Factory-calibrated and field-adjustable assembly with shaft extension for connection to externally mounted control actuator.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 6-inch wg inlet static pressure.

E. Attenuator Section: Casing and Lining same as described above.

2.6 AIR VALVES

A. Description:

1. Aluminum or stainless steel venturi valve.
2. Internal shaft and mounting brackets shall be from 316 stainless steel. All shaft bearing components shall be coated in Teflon, polyester, or polyphenylene sulfide composite.
3. There shall be no minimum straight duct length requirement at intake or discharge connection to achieve desired setpoints.
4. Insulation shall be factory applied and shall not expose any fibers to the air stream.
5. Air valve shall maintain accuracy within +/- 5% of signal.

B. Controllers:

1. VAV Terminal Unit controllers must be compatible with existing Tridium Niagara 4 building automation system at McKee Medical Center.
2. Air valve to be pressure independent and not use flow or velocity to maintain setpoint. Modulation between setpoints shall be linear and shall retain +/- 5% accuracy between maximum and minimum values with a response time of less than one second. Air valves are intended to maintain constant airflow at hoods in hazardous drug prep room, manually balanced at start-up and re-certifications. Air valves are not intended to modulate or vary airflow rates. Air valves are intended to communicate status to BAS, including available parameters, such as plunger position and air pressure differential across air valve.
3. DDC controllers shall have integral PID loops and non-volatile rewriteable memory for control algorithm storage. Memory shall be field writeable. All required power shall be 24 VAC.
4. Air valves shall fail at last known position, unless otherwise indicated.
5. Models:

a. Antec Controls, VV Venturi Valve (or equal)

C. Shut-off control: When the air valve is in the closed position and under 5.0" wg differential, the assembly shall leak no more than:

1. Standard Leakage up to 1300 cfm:

a. Valve: 6 cfm.
b. Casing: 0.12 cfm/sq.ft.

2. Low Leakage up to 1300 cfm:

a. Valve: .005 cfm.
b. Casing: .010 cfm/sq.ft.

D. Accessories:

1. Local Display: Room level controller with visual display for reporting of air valve performance. Display shall allow at least 200 characters with high contrast.
2. Local Alarm: Room level audible and visual indicators for when space is in and out of control setpoints.
3. Coatings: Phenolic or other coating suitable to protect all exposed air valve components from corrosive service.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units level and plumb.

B. Maintain sufficient clearance for normal service and maintenance to all portions, including coil connections.

1. Provide at least 24" clear in front of terminal unit control panel access.
2. Provide at least NEC clearances in front of terminal unit disconnects.

3.2 AIR VALVE APPLICATIONS

A. Hazardous Drug Preparation Hoods

1. Type: Venturi
2. Body Material: Aluminum or Stainless Steel
3. Controller Model: Celeris, Traccel or Theris.
4. Operation type: Constant volume.
5. Provide factory insulation around valve body.
6. Services: Exhaust.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air terminal units to allow service and maintenance.

C. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange. Provide a minimum of three 90 degree ells from tap to terminal box and reheat coil connections.

D. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts" or "Nonmetal Ducts," as required by duct material.

E. Ground units with electric heating coils according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

H. Connect to room occupancy sensor and FMS for setback during non-occupied periods.

I. Install 24VAC transformer for all terminal unit controls.

J. Install discharge air temperature sensor at each terminal unit.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.

2. Leak Test: After installation, fill water coils 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. Remove and replace malfunctioning units and retest as specified above.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 233600

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections include the following:

1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
3. Division 23 Section "Particulate Air Filtration" for HEPA media applied in HEPA filter grilles.

## 1.2 ACTION SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate drawing designation, model number, size, materials of construction, finish, and mounting details; and performance data including throw and drop, accessories, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, model number, size, and accessories furnished.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Kreuger.

B. MetalAire, Inc.; Metal Industries Inc.

C. Nailor.

D. Price Industries.

E. Titus.

## 2.2 CAPACITIES AND CHARACTERISTICS

A. Provide Grilles, Registers, and Diffusers with capacities and characteristics as indicated in the drawings.

B. Maximum NC shall be 25 at CFM indicated, including neck damper.

C. Coordinate frame style with drawings.

D. Finish: Baked enamel, color selected by Architect.

E. Ceiling mounted critical environment grilles, registers, and diffusers shall have an independent hanger or chain to structure.

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.

C. Deliver and store clean and shrink wrapped. Touch up any paint damage.

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 practicable. 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. Install insulation blankets on the back-pan of all air devices directly under an exposed roof. Refer to Division 23 "HVAC Insulation – Duct, Equipment, and Piping".

E. At each ceiling and sidewall take-off from a duct, install an adjustable volume extractor with appropriate operator. Refer to Division 23 "Air Duct Accessories".

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

# PART 1 - GENERAL

## 1.1 SUMMARY

A. The requirements contained in this Section apply to all Sections of this Division.

B. Section Includes:

1. Common terminology and requirements used throughout this Division.
2. Requirements for Acceptance Testing Agency.
3. Requirements for Professional Engineers responsible for Delegated Design.
4. Electrical equipment coordination and installation.
5. Sleeves for raceways and cables.
6. Sleeve seals.
7. Grout.
8. Common electrical installation requirements.

## 1.2 DEFINITIONS

A. AHJ: Authorities Having Jurisdiction.

B. ANSI GRAY: Where this Section and other Sections of this Division use the term "ANSI GRAY" it shall mean the manufacturer's standard ANSI Gray.

C. Bound Material: Bound refers to materials permanently bound, as by stitching or glue, or materials securely fastened in their covers by multiple fasteners that penetrate all papers. Ring binders, spiral binders, brads and screw posts are acceptable fasteners. Loose papers clipped together or stapled at one corner are not acceptable.

D. Business Day: Where this Section and other Sections of this Division use the term "Business Day" it shall mean Monday thru Friday, excluding Holidays recognized by Federal, State and Local government.

E. EPDM: Ethylene-propylene-diene terpolymer rubber.

F. FMS: Facility management system.

G. NETA ATS: Acceptance Testing Specification, as published by InterNational Electrical Testing Association.

H. NBR: Acrylonitrile-butadiene rubber.

I. NIST: National Institute of Science and Technology.

J. RS-232: A TIA standard for asynchronous serial data communications between terminal devices.

K. RS-485: A TIA standard for multipoint communications using two twisted-pairs.

L. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

1.3 PERFORMANCE REQUIREMENTS

A. The Drawings diagrammatically show the sizes and locations of various equipment and devices, and the sizes of the major interconnecting wires, without showing exact details as to elevations, offsets, control wiring and other installation requirements. Carefully layout the Work at the site to conform to the architectural and structural conditions, to avoid obstructions and to permit proper grading of pipe associated with other portions of the Work. In cooperation with other trades, determine the exact location of equipment and devices and connections thereto by reference to the submittals and rough-in drawings, and by measurements at the site. Make minor relocations necessitated by the conditions at the site, or directed by the Owner, without additional cost to the Owner.

1.4 SUBMITTAL PROCEDURES

A. Common Requirements for Product Data: Where this Section and other Sections of this Division require Product Data to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Submit hardcopy of Product Data in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of product data submittals shall be bound materials as defined above. Separate products under distinct subheadings that correspond to paragraphs in specification text. Divide sections in binder with labeled divider tabs.
2. In addition to hardcopies required by Division 01, submit one copy of product data in electronic format. All files shall be in Portable Document Format (.pdf).
3. Product Data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.

B. Common Requirements for Shop Drawings: Where this Section and other Sections of this Division require Shop Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Prepare Shop Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®.
2. Submit hardcopy of Shop Drawings in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of Shop Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format. Files shall include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
4. Shop Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.

C. Common Requirements for Coordination Drawings: Where this Section and other Sections of this Division require Coordination Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" and Division 01 Section "Project Management and Coordination". In addition to the requirements of Division 01 comply with the following:

1. Prepare Coordination Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®. Drawings files must be composite with multiple distinctive layers for each of the various trades.

2. Submit hardcopy of Coordination Drawings in the quantity as required under Division 01. Hardcopies of Coordination Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format. Files shall include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
4. Coordination Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.

D. Common Requirements for Specification Compliance Certification: Where this Section and other Sections of this Division require Specification Compliance Certification to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" for "Other Informational Submittals". In addition to the requirements of Division 01 comply with the following:

1. Prepare a line-by-line Specification Compliance Certification by marking up a copy of the Contract Document specification section in the left margin. Accompany the markup with a written report explaining all items that are not marked with "Compliance". Submit line-by-line markup, written report of deviations and alternates and a cover letter certified by Manufacturer or Installer that prepared the Specification Compliance Certification. Use the following key for preparing the line-by-line markup.

   a. "C" for Compliance: By noting the term "compliance" or "C" in the margin, it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
   b. "D" for Deviation: By noting the term "deviation" or "D" in the margin, it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified.
   c. "A" for Alternate: By noting the term "alternate" or "A" in the margin, it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner.
   d. "N/A" for Not Applicable: By noting the term "not applicable" or "N/A" in the margin, it shall be understood that the specified item is not applicable to the project.

E. Common Requirements for Qualification Data:

1. Professional Engineer Qualifications: Where this Section and other Sections of this Division require a Professional Engineer to be responsible for Delegated Design requirements; Submit Qualification data for Professional Engineer including, but not limited to, proof of registration in the Project location.

2. Independent Testing and Inspecting Agency Certification: Where this Section and other Sections of this Division require an Independent Testing and Inspecting agency to be responsible for Acceptance Testing and Field Quality Control requirements; Submit certification documentation for such agency that demonstrates compliance with the Quality Assurance paragraph of this Section.

1.5 ACTION SUBMITTALS

A. Product Data: Submit product data for each of the following.

1. Sleeves.
2. Sleeve seals.
3. Grout.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Prepare drawings showing dimensioned layout for the following:

1. Penetration and Structural Opening: Floor plans showing sleeves and formed structural penetrations. Show sleeve and formed penetration layouts and relationships between structural components and other adjacent building elements, including but not limited to pre-tensioning and post-tensioning members where used.
2. Reflected Ceiling Plans: ceiling plans, sections, and other necessary details showing dimensioned layouts for equipment located in or on the ceiling plane. Base dimensions on exact dimensioned data obtained from product submittals for products to be included in the Work. Differentiate between field measurements and assumed dimensions. Include the following items coordinated with each other, based on input from installers of the items involved:

    a. Suspended ceiling components.
    b. Structural members to which suspension systems for luminaires will be attached.
    c. Perimeter moldings, decorative ceiling elements, and Architectural features.
    d. Luminaires.
    e. HVAC Diffusers, Registers and Grilles.
    f. Speakers.
    g. Sprinklers.
    h. Fire Alarm initiating devices, including but not limited to the following:

        1) Smoke detectors.
        2) Heat detectors.
        3) Flame detectors.

    i. Fire Alarm notification appliances.
    j. Occupancy sensors.
    k. Access panels.
    l. Security cameras and occupancy detectors.
    m. Wireless Access Points.
    n. Nurse Call Zone and Dome Lights.
    o. Patient Telemetry Receivers and Equipment.

3. Electrical Equipment Layouts: Floor plans, elevations, and other necessary details showing dimensioned layouts for spaces containing electrical equipment. Base electrical equipment dimensions on exact dimensioned data obtained from product submittals for products to be included in the Work. Differentiate between field measurements and assumed dimensions. Include the following items coordinated with each other, based on input from installers of the items involved:

    a. Electrical equipment layout and relationships between components and adjacent structural and mechanical elements.
    b. Indication of required working clearances and required area above and around electrical equipment where pipes and ducts are prohibited.
    c. Location of Conduit entry into electrical equipment.
    d. Location of luminaires, sprinkler piping and heads, ducts, and diffusers.
    e. Electrical equipment support locations, type of support, and weight on each support.
    f. Location of structural supports for structure-supported raceways.
    g. For floor mounted equipment: concrete base dimension, outline of equipment, and required clearances.

1.7 QUALITY ASSURANCE

A. Common Requirements for Independent Testing and Inspecting Agency Qualifications: Where this Section and other Sections of this Division call for an Independent Testing and Inspecting Agency (Testing Agency); the Testing Agency shall comply with the following requirements:

1. Have the experience and capability to conduct the testing indicated,
2. Be a member company of the InterNational Electrical Testing Association (NETA) or a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction and the Engineer-of-Record.
3. Meet the Requirements of NETA ATS 3.0 including, but not limited to, the following:

   a. Be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated.
   b. Be regularly engaged in the testing electrical equipment devices, installations, and systems.
   c. Use technicians who are regularly employed for testing services.
   d. Have a "Full Membership" classification issued by the InterNational Electrical Testing Association meets the above criteria.

4. Testing Agency's Field Personnel: Technicians performing specified electrical tests and inspections shall meet the Requirements of NETA ATS 3.0 including, but not limited to, the following:

   a. Technicians performing specified electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgment on the serviceability of the specific equipment.
   b. Technicians shall be certified in accordance with ANSI/NETA ETT-2000, Standard for Certification of Electrical Testing Personnel. Each on-site crew leader shall hold a current certification, Level III or higher, in electrical testing.

B. Common Requirements for Material Quality: Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall be replaced with new materials, equipment or devices identical with those damaged, unless approved otherwise by the Owner in writing.

C. Common Requirements for Code Compliance: In case where differences occur between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. Perform the following:

1. Promptly notify the Architect in writing of any such difference.
2. Obtain approval from Architect before proceeding with the Work.
3. Should the Contractor perform any work that knowingly does not comply with local codes, laws and ordinances, industry standards, or other governing regulations; the Work shall be corrected at no cost to the Owner.

D. Common Requirements for Compliance with AHJ Instructions: In cases where the Authority Having Jurisdiction requires deviations from the requirements of the Contract Documents, perform the following:

1. Promptly notify the Architect in writing of any such difference.
2. Obtain approval from Architect before proceeding with the Work.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided shall meet the requirements of the UL standard.

1.8 PRODUCT SUBSTITUTIONS

A. Comply with provisions of Division 01 Section "Product Substitution Procedures".

1. If item of equipment or device offered as Substitution differs in dimension or configuration from that indicated in the Contract Documents, provide, as part of the substitution submittal, a drawing that shows that the equipment or devices proposed for Substitution can be installed in the space available without interfering with other trades or with access requirements for operations and maintenance in the completed project. Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.
2. Where substitute equipment or devices requires different arrangement or connections from that indicated in the Contract Documents, install the equipment or devices to operate properly and in accordance with the requirements of the Contract Documents. Make incidental changes necessary in piping, ductwork or wiring which results from the inclusion of the substitute equipment or device without any additional cost to the Owner. Pay all additional costs incurred by other trades in connection with changes required by the inclusion of the substituted equipment or device in the Work.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect Construction Manager and Owner no fewer than five business days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Architect's Construction Manager's and Owner's written permission.

B. Schedule of Work in Existing Facilities:

1. The building will continue in use throughout the construction period, carry out the Work in such a manner as to minimize disturbance to the occupants.
2. The schedule contemplates working in designated areas in the existing building while other adjacent areas are still being occupied. Carry out the Work in such a manner as to minimize disturbance to those occupied areas.
3. Should the Work in the designated areas affect any services to the areas that are to remain in use, new permanent or temporary services or a combination of both shall be installed as required to enable those occupied areas to function properly and without interruption.
4. Perform no work in the existing building which would interfere with its use during normal hours of occupancy, Including but not limited to operations which would cause objectionable noise or service interruptions, unless special permission is granted by the Owner.

C. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving large equipment into place. Where any piece of equipment is too large for ingress through normal building openings it shall be placed in its containing space before the enclosing structure is completed.

D. Temporary Power: Where temporary power is required during the construction period, comply with ANSI/NECA 200 "Recommend Practice for Installing and Maintaining Temporary Power at Construction Sites."

1.10 COORDINATION

A. In describing various materials, equipment and devices, in general each item may be described singularly, even though there may be a multiplicity of identical items. Also, where the description is general in nature, the exact sizes, duties, space arrangements, horsepower and other requirements must be obtained by reference to other portions of Contract Documents.

B. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer. Verify that all materials, equipment and devices proposed for use on this Project are within the constraints of the allocated space.

C. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping, ductwork and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

D. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

E. Utility Service Coordination:

1. Electrical Service: Coordinate the location of the electrical service entrance with the electric utility company and with other trades. Provide materials and equipment required to connect the electrical service.

F. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

G. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

H. For roof-mounted equipment: Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

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

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The Drawings do not indicate existing installations other than to identify modifications or extensions thereto. Visit the site and ascertain the existing conditions. Review construction details of the existing portion of the building during the site inspection. Include all work required to remove or modify portions of the existing installation in order to accommodate the new Work. Failure to comply with this will not be considered grounds for additional payment in connection with removing or modifying any part of the existing installation or installing any new or temporary work.

3.2 TEMPORARY WORKING ACCESS

A. Remove existing wire, conduit, equipment, fixtures, and other items as required to provide access for Work in existing facilities.

B. Reinstall and refinish items removed, or otherwise damaged, to match existing adjacent conditions upon completion of the Work.

3.3 SALVAGE, DEMOLITION AND RELOCATION

A. Modify, remove, salvage, or relocate materials, equipment and devices as indicated or required by the installation of new Work.

B. Salvage and Demolition: Working jointly with the Owner's Representative, establish and mark salvage and demolition items before commencing work; report items scheduled for relocation, reinstallation or reuse, which are found to be in damaged condition; await further instructions from the Owner before commencing Work.

1. Demolition material shall be removed from the site and disposed of in a legal manner.
2. Salvaged equipment and devices shall be the property of the Owner, unless otherwise indicated. Store salvaged items in locations as directed by Owner.
3. For devices and equipment marked for demolition, remove all conduit and wiring back to the point of origination, unless otherwise indicated.
4. Where existing walls are demolished, remove all existing electrical devices, their associated conduit and wiring back to the point of origination.
5. Where entire circuits are removed, turn the circuit breaker off and label as "spare".
6. Maintain service to all "existing to remain" devices and equipment that may be interrupted during demolition.
7. Upon completion of demolition, ensure that remaining devices that may have been interrupted during demolition are energized.

C. Relocations: Make minor relocations necessitated by the conditions at the site or as directed by the Owner's Representative, without additional cost to the Owner.

1. Remove items which are to be relocated in reverse order to original assembly or placement.
2. Protect items until relocation is complete.
3. Clean, Repair and restore to good functional condition, equipment, materials and items scheduled for relocation. Provide new fittings and appurtenances required to complete the relocations and to restore to good operating order.

D. Substitution of New materials for Relocation: New materials of similar design and quality may be substituted for materials and items indicated to be relocated upon approval of Owner and Architect. Comply with Division 01 for Substitution Procedures.

3.4 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. All materials, equipment and devices shall be installed in accordance with the recommendations of their manufacturer.

B. Comply with NECA 1 - Standard Practices for Good Workmanship in Electrical Construction, as published by the National Electrical Contractors Association.

C. Use licensed technicians skilled in their respective trades for installation of the Work.

D. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items, unless otherwise indicated.

E. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

F. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a manner as to facilitate future disconnecting with minimum interference with other items in the vicinity.

G. Right of Way: Give to piping systems installed at a required slope.

H. Access Panels: Provide wall and ceiling access panels for unrestricted access to all concealed electrical equipment items and devices installed behind furrings, chases or non-removable suspended ceilings. Access Panel materials and installation requirements are specified in Division 08 Section "Access Doors and Frames."

I. Installation Inspections and Certifications

1. Obtain timely inspections of the installation by Authorities Having Jurisdiction. Remedy any deficiencies to the satisfaction of the inspecting official.
2. Upon final completion of the Work, obtain certificates of acceptance from the Authorities Having Jurisdiction. Deliver the certificates to the Owner.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves where cable or conduit penetrations occur. Install sleeves during erection of slabs and walls.

1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Exception: Slab-on-grade construction shall not require sleeves or curbed formed openings when conduits or pipes that penetrate the slab-on-grade are installed and properly supported prior to the pouring of the slab.

C. Masonry Walls: Install sleeves where cable or conduit penetrations occur. Install sleeves during erection of walls.

1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

F. Non Fire-Rated Assemblies: Install sleeves where cable penetrations occur. Install sleeves during erection of walls.

1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

G. Cut sleeves to length for mounting flush with both surfaces of walls.

H. Extend sleeves installed in floors a minimum of 2 inches above finished floor level.

I. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless otherwise indicated or.

J. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
2. Apply approved joint compound for gypsum board assemblies where masonry or concrete wall is faced on interior side with gypsum board.

K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

M. Roof-Penetration Sleeves: Seal penetration of individual conduits and cables with flashing units applied in coordination with roofing work. Provide flashing unit as specified in Division 07 Section "Sheet Metal Flashing and Trim".

N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

O. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.6 OPTION TO RELOCATE DEVICES

A. The location of power, wall switches and other similar devices along with their associated connections may be relocated at the Owner's option, at no additional cost to the Owner, to a point within 10 feet of their present location provided the Contractor is notified prior to rough-in or installation.

3.7 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.8 UTILITIES

A. The location and voltage of electrical lines included within the Work are indicated in the Contract Documents in accordance with information furnished by the Owner. Existing utility lines not indicated in Contract Documents but encountered during construction shall be protected, relocated or capped as directed by the Owner.

B. Prior to excavation, examine the site and verify the location and elevation of all utilities and their relation to the Work. Identify and label all underground utilities occurring within the bounds of the area to be excavated. Contact the known utilities and engage a certified locator service to assist in this effort.

C. Prior to excavation, contact the known utilities and inform them of excavation work plan. Proceed with excavation only after receiving approval from Utilities.

D. All precautions shall be exercised to prevent damage to existing lines, but should work become necessary, it must be authorized prior to execution except in an emergency situation.

E. Should damage result to any utility through the Contractor's negligence or failure to comply with the above directives, the Contractor shall bear the sole responsibility to correct such damage and shall be responsible for all expenses incurred in the expeditious repair or replacement of such damaged Utilities.

F. Repair of damaged utilities shall be to a condition equal to or better than the adjacent undamaged portion of such utility and to the complete satisfaction of the Owner and respective Utility.

3.9 CONNECTIONS

A. Phase Rotation: Prior to installing any connections or energizing any equipment, perform Phase Rotation verification test at the following:

1. Utility Transformers
2. Engine Generators
3. Motors
4. Connections to existing electrical equipment.

B. Mechanical Controls: Provide 120VAC power connections as required to components of Mechanical Control system. Coordinated quantity of circuits, connection requirements and locations between trades and with provisions of Divisions 21, 22, and 23 sections.

C. HVAC Terminal Boxes: Where the Drawings indicate a 120VAC circuit in a general area and labeled for terminal boxes (VAV, etc.), the intent is for this circuit to be extended and connected to the terminal box in that general area. Coordinate connection requirements and locations between trades and with provisions of Division 23 Sections and Drawings.

D. Smoke Dampers: Where the Drawings indicate a 120VAC circuit in a general area and labeled for dampers, the intent is for this circuit to be extended and connected to the Smoke and Fire/Smoke dampers in that general area in coordination with the smoke control sequence. Coordinated connection requirements and locations between trades and with provisions of Division 23 Sections and Drawings.

E. Security and Access Control: Where the Drawings indicate a 120VAC circuit in a general area labeled for security or access control use, the intent is for this circuit to be extended and connected to the security or access control device in that general area in coordination with other trades. Coordinated connection requirements and locations between trades and with Owner's Security vendor prior to installation.

F. Motors and Motor Connections: Motors for driven equipment are specified in Divisions 21, 22, and 23. Provide connections as follows, unless otherwise indicated:

1. Equipment provided with factory installed disconnecting means: Upon installation of motor and associated equipment, Provide the electrical installation in accordance with approved wiring diagrams and manufacturer's written instructions.
2. Equipment furnished with factory disconnecting means: Upon installation of motor and associated equipment, Install factory furnished disconnecting means and provide the electrical installation in accordance with approved wiring diagrams and manufacturer's written instructions.
3. Equipment not furnished with factory installed disconnecting means: Provide disconnect switch required in accordance with NFPA 70 or as indicated on the Drawings. Provide the electrical installation in accordance with approved wiring diagrams and manufacturer's written instructions.

G. Owner Furnished Equipment: Power Connections and Control wiring required for Owner Furnished Equipment may not be shown on the Drawings. This wiring shall be provided. Coordinated connection requirements and locations with Owner.

1. Request all rough-in documentation required for proper installation of the electrical work in ample time to permit preparation of the installation drawings.

## 3.10 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

B. Apply putty pads to boxes located in fire-rated wall assemblies in which a horizontal distance of greater than 24" between boxes is not maintained. Putty pad materials and installation requirements are specified in Division 09 Section "Gypsum Board Assemblies."

3.11 SEALANT

A. Apply sealant to penetrations of all floor and wall assemblies to maintain pressure differentials required by AIA for all pressure sensitive rooms including: Isolation rooms, Protective Environment rooms, and Operating rooms. Sealant materials and installation requirements are specified in Division 07 Section "Joint Sealants" and Division 09 Section "Gypsum Board Assemblies.

3.12 FIELD QUALITY CONTROL

A. Conduct tests as part of the Work of this Division. Include the services of qualified personnel as well as all equipment, apparatus, and services required.

B. Conduct tests under conditions free from short circuits and from grounds.

C. Insure insulation resistance prior to test is within the requirements of the latest edition of the NFPA 70.

D. Prior to execution of testing, notify Architect of proposed test procedures and forms.

E. Testing requirements are listed under individual sections of this Division. Sections requiring testing include, but are not limited to the following:

1. Wire and cable insulation, in accordance with Division 26 Section "Low-Voltage Electrical Power Conductions and Cables."
2. Grounding system continuity, in accordance with Division 26 Section "Grounding and Bonding for Electrical Systems."
3. Underground ducts and raceway integrity, in accordance with Division 26 Section "Underground Ducts and Raceways for Electrical Systems."
4. Monitoring operational and system continuity, in accordance with Division 26 Section "Electrical Power Monitoring and Control."
5. Lighting control devices, in accordance with Division 26 Section "Lighting Control Devices."
6. NETA tests for transformers, in accordance with Division 26 Section "Low-Voltage Transformers."
7. NETA tests and startup for switchboards, in accordance with Division 26 Section "Switchboards."
8. NETA tests and startup for panelboards, in accordance with Division 26 Section" Panelboards."
9. NETA tests and startup for isolation panelboards, in accordance with Division 26 Section "Isolation Panelboards."
10. Receptacle retention force, polarity, and ground resistance testing,in accordance with Division 26 Section "Wiring Devices."
11. NETA tests and startup for enclosed switches and circuit breakers, in accordance with Division 26 Section "Enclosed Switches and Circuit Breakers."
12. NETA tests and startup for enclosed controllers, in accordance with Division 26 Section" Enclosed Controllers."
13. NFPA 110 acceptance tests and startup for generators, in accordance with Division 26 Section "Engine Generators."
14. NETA tests and startup for transfer switches, in accordance with Division 26 Section" Transfer Switches."
15. NETA tests for surge protection devices, in accordance with Division 26 Section" SPD for Low-Voltage Electrical Power Circuits."
16. Emergency lighting tests, in accordance with Division 26 Section "Interior Lighting."
17. Illumination tests, in accordance with Division 26 Section" Exterior Lighting."
18. NETA thermographic survey on all electrical system equipment.

END OF SECTION 260500

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

## 1.2 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

C. VFC: Variable frequency controller.

## 1.3 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

B. Product Data: For each type of product indicated. Provide data for conductors and cables including, but not be limited to, the following:

1. Complete physical properties of the conductors and cables.
2. Ampacity for use intended.
3. Allowable stresses and requirements for installations, including bend radii, linear stress, and other pertinent data.
4. Types of connectors for terminations.

## 1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit Coordination Drawings in accordance with Division 26 Section "Common Work Results for Electrical". Include the following:

1. Feeder cable routing plans, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

a. Structural members in the paths of conduit groups with common supports.
b. HVAC, plumbing items, and architectural features in the paths of conduit groups. Denote where systems share common supports.

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For conductors and cables, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:

1. Manufacturer's routine maintenance requirements for cables, terminations and all installed components.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For independent agency as defined in Division 26 Section "Common Work Results for Electrical".

1.7 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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

1. Alcan Products Corporation; Alcan Cable Division.
2. Alpha Wire.
3. Belden Inc.
4. Encore Wire Corporation.
5. General Cable Technologies Corporation.
6. Southwire Incorporated.

B. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. XHHW Conductors: Comply with NEMA WC 70.

D. Aluminum Conductors: XHHW-2

1. Comply with NEMA WC 70.
2. AA-8000 series electrical grade aluminum alloy conductor material in compliance with NFPA 70, Chapter 3.
3. Compact stranded conductors.

E. Shielded Variable Frequency Drive Cable: Shielded Conductor and signal cable with symmetric bare grounds and overall shield to block EMI and RFI interference.

1. Conductor Material: stranded tinned copper
2. Shield: Foil tape and tinned copper braid shield
3. Comply with 2000V UL 1277 Type TC-ER per 2005 NEC Article 336
4. Rated for 90°C wet/dry
5. Suitable for Class I & II; Division 2 hazardous locations

6. Comply with UL 1685 vertical tray flame test
7. Comply with IEEE 1202 vertical tray flame test at 70,000 BTU/hour
8. Comply with CSA FT4
9. Comply with Oil & Sunlight resistant
10. RoHS compliant and CE approved.

F. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Types THHN-THWN, XHHW, XHHW-2 and SO, as indicated.

G. Multiconductor Cables: Comply with NEMA WC 70/IECA S-95-658; Exterior sheath color coded to differentiate cable voltages and quantity of phase conductors.

1. Health Care Facilities Metal-clad cable, Type MC$^{AP}$-HCF; Comply with UL 1569 and UL 1063; with green grounding conductor(s) in addition to full size aluminum ground wire/sheath combination that is listed for sheath to act as second ground path; with exterior sheath colored green.

2. Type SO; with green grounding conductor(s).

2.2 CONNECTORS AND SPLICES

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

1. AFC Cable Systems, Inc.
2. Gardner Bender.
3. Hubbell Power Systems, Inc.
4. Ideal Industries, Inc.
5. Ilsco; a branch of Bardes Corporation.
6. NSi Industries LLC.
7. O-Z/Gedney; a brand of the EGS Electrical Group.
8. 3M; Electrical Markets Division.
9. Tyco Electronics.
10. WAGO Corporation.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 MISCELLANEOUS PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 lb, minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding. Refer to Division 26 Section "Identification for Electrical Systems" for color-coding requirements.

2.4 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for all feeders, aluminum for feeders where indicated on Drawings. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Provide conductors with minimum temperature ratings of 75 degrees C. For high temperature applications, provide conductors with temperature ratings in accordance with the NFPA 70 for the ambient condition.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance:

1. Copper: Type THHN-THWN, single conductors in raceway.

2. **Aluminum:** Type XHHW-2, single conductors in raceway, where indicated on Drawings.

B. Exposed Feeders:

1. Copper: Type THHN-THWN, single conductors in raceway.

2. **Aluminum:** Type XHHW-2, single conductors in raceway, where indicated on Drawings.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces:

1. Copper: Type THHN-THWN, single conductors in raceway.Retain selection below for HCA. HCA requires normal feeders 200A and over to be designed as Aluminum or Copper, under 200A shall be copper. Essential electrical system is NOT allowed to be Aluminum for HCA.
2.

D. Feeders below Slabs-on-Grade, and Underground:

1. Copper: Type THHN-THWN, single conductors in raceway.

2. **Aluminum:** Type XHHW-2, single conductors in raceway, where indicated on Drawings.]

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway Type AC-HCF and Type MCAP-HCF in limited locations where indicated.

1. Type AC-HCF and Type MC$^{AP}$-HCF are acceptable for the following applications.

a. Install cables for lighting fixture whips and for branch circuits concealed in walls and partitions only.

1) Do not install the cable in the vertical web of metal studs.
2) Route cable horizontally using pre-fabricated openings in web of metal stud.
3) Use only single-circuit cable (i.e. two wire plus ground). For devices in the same wall connected to different circuits, install separate single circuit cable for each circuit.

4) Locate junction box and convert to single conductors in rigid raceway within 24-inches from the point the cable exits the wall.

2. Type AC-HCF and Type MC$^{AP}$-HCF are not acceptable for the following applications; instead provide single conductors in rigid raceway.

a. Homeruns to Panelboard.
b. Branch circuits serving Essential Electrical System (Emergency & Standby) loads; including Life Safety branch, Critical branch and equipment emergency system.
c. Branch circuits serving HVAC, elevator/escalator, medical and kitchen equipment loads.
d. Within mechanical, electrical or telecommunication equipment rooms.
e. Exposed Branch Circuits within areas that do not have a ceiling (i.e. open to structure).
**f.** Wet Locations.

G. Branch Circuits below Slabs-on-Grade, and Underground in limited locations where indicated: Type THHN-THWN, single conductors in raceway.

H. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

**I.** Branch Circuits served from Isolation Panelboards: Copper stranded Low leakage Type XHHW conductor with a dielectric constant of 3.5 or less in raceway.

J. Connections to Luminaires on Normal System: Armored Cable, Type AC-HCF, maximum of 144 inches (3660 mm).

K. Connections to Luminaires on Essential/Emergency System: Armored Cable, Type AC-HCF, maximum of 144 inches (3660 mm).

L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

M. Class 1 Control Circuits: Type THHN-THWN, in raceway.

N. Class 2 and 3 Control Circuits; Concealed in Ceilings, Walls or Partitions: Power-limited cable or Type THHN-THWN, in raceway.

O. Class 2 and 3 Control Circuits; Exposed: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Run feeders in continuous lengths, without joints or splices. Where continuous runs are impractical; obtain Engineer's approval for splice locations and application.

B. Make joints in branch circuits only where circuits divide.

C. Do not use gutters of panelboards as raceways, junction boxes, or pull boxes for conductors not terminating in said panelboards.

D. Run conduits for emergency power conductors separate from all other wiring.

E. Make splices and terminations in cables with kits and instructions provided by the kit manufacturer. Each splice shall equal the integrity of the cable electrically and environmentally.

F. Bundling Conductors: Bundle conductors in switchboards, panelboards, cabinets, and the like, using nylon ties made for the purpose. Bundle conductors larger than No. 10 in individual circuits. Smaller conductors may be bundled in larger groups.

G. Install all conductors in raceways, unless otherwise indicated.

H. Sizes:

1. Provide conductors no smaller than No. 12 AWG, except for signal or control circuits.
2. Provide No. 10 AWG conductors for home runs on 120-volt, 20-ampere branch circuits, where the conductor length exceeds 100 lineal feet from panelboard to the first device.
3. Provide No. 10 AWG conductors for home runs on 277-volt, 20-ampere branch circuits, where the conductor length exceeds 200 lineal feet from panelboard to the first device.
4. Provide neutral conductors of the same size as the phase conductor(s) for individual branch circuit homeruns.

5. Run dedicated neutral conductor with each branch circuit. Sharing of neutral conductors in multi-circuit homeruns is not acceptable.

   a. Sharing of neutrals would necessitate the use of multiple-pole or tied branch circuit breakers to allow simultaneous disconnecting of current caring conductors in order to comply with NFPA 70 requirements and therefore is unacceptable.

6. Grouping of Multi-Circuit homeruns: grouping of multiple circuits into shared conduit homeruns is acceptable where they comply with the quantities and sizes listed in Table "A" below and where homeruns meet the following conditions:

   a. Where conductors are THWN/THHN installed in dry location.
   b. Where raceways are installed in ambient conditions less than 30-Deg C (86-Deg F).
   c. Consider neutral conductors as a current carrying conductor in branch circuits which serve receptacles or electronic ballasted luminaries.

TABLE A

| Number of Current Carrying Conductors in single raceway | Conductor Size for 20Ampere Single Pole Circuit | Conduit Size based on EMT |
|---|---|---|
| 2 to 3 | #12 AWG (THHN 75-Deg) or #12 AWG (THHN 90-Deg) | 3/4" EMT |

| | | |
|---|---|---|
| 4 to 6 | #12 AWG (THHN 75-Deg) or<br>#12 AWG (THHN 90-Deg) | 3/4" EMT |
| 7 to 9 | #10 AWG (THHN 75-Deg) or<br>#12 AWG (THHN 90-Deg) | 1" EMT<br>3/4" EMT |
| 10 to 12 | #10 AWG (THHN 90-Deg) | 1.25" EMT |

Notes:

1. Conductor and conduit sizes in table above are based on total conductor lengths under 100 lineal feet for 120-volt (200 lineal feet for 277-volt) from panelboard to the first device, 20-ampere branch circuits. Increase conductor and conduit size in accordance with NFPA 70 for longer lengths.

I. Terminations of multiple branch circuit conductors on a single circuit breaker is not acceptable.

J. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

K. Complete raceway installation between conductor and cable termination points according to Division 16 26 Section "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

L. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours.

M. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

N. Feeders and Branch circuits concealed in concrete are prohibited.

3.4 WIRE PULLING

A. Pull no conductors into conduits until all Work of a nature which may cause injury to conductors is completed.

B. Follow manufacturers' recommendations for regulating temperature conditions of conductors prior to installation.

C. Exercise care in handling and installing cables to avoid damage. Carefully form cables in equipment pull boxes. Form bends in cables larger than the minimum radii shown in the cable manufacturer's published data for minimum bends such that bends will not reduce the cable life.

D. Provide suitable installation equipment to prevent abrasion and cutting of conductors by raceways during the pulling of conductors. Use ropes of polyethylene, nylon or other suitable nonmetallic material to pull in feeders. Metallic ropes are prohibited.

E. Attach pulling lines to conductors by means of insulated woven basket grips or by pulling eyes attached directly to conductors. Do not use rope hitches, or bare steel basket grips. All conductors to be installed in a single conduit shall be pulled in simultaneously.

F. Before any wire is pulled into any conduit, thoroughly swab the conduit to remove all foreign material and to permit the wire itself to be pulled into a clean, dry conduit.

G. Use manufacturer-approved pulling compound or lubricant where necessary, of non-conducting type. Compounds used must not deteriorate the conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

H. Do not use cable pulling lubricants on conductors of ungrounded circuits which are electrically monitored by ground detector system, since such lubricant may increase the capacities to ground of these conductors. Including, but not limited to, conductors on the secondary side of Isolation Panels.

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor.

C. Wiring at Outlets: Install conductor at each device, with at least 6 inches (150 mm) of slack.

D. Wiring at lighting control locations: Install a neutral conductor at each switch location controlling line-to-neutral lighting loads.

E. Connectors: Make splices and connections in conductors using approved connectors.

1. Provide lugs and connectors of proper size to match conductor size.
2. Stranded Conductors: Solder-less, bolted pressure or compression connectors.
3. Solid Conductors: Bolted pressure or spring connectors.
4. Motor Lead Pigtails: Crimp lugs with through-bolt fasteners between lugs. Furnish proper sized dies and tools to apply connectors.
5. Lighting Fixture Taps: Electrical spring connectors as specified for solid conductors.
6. Ground Connections: Ground connection materials and installation requirements are specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Provide temperature ratings of connectors and splices to match wire rating.

G. **C**onnections for Aluminum Conductors using Mechanical Screw Type Connectors:

1. Connectors shall be dual rated (AL7CU or AL9CU) and Listed by UL for use with aluminum and copper conductors and sized to accept aluminum conductors of the ampacity specified.
2. Using a suitable stripping tool, to avoid damage to the conductor, remove insulation from the required length of the conductor.
3. Clean the conductor surface using a wire brush and apply a Listed joint compound.
4. Tighten the connection per the connector manufacturer's recommendation.
5. Wipe off any excess joint compound.

H. Connections for Aluminum Conductors using Mechanical Compression Type Connectors:

1. Connectors shall be dual rated (AL7CU or AL9CU) and Listed by UL for use with aluminum and copper conductors and sized to accept aluminum conductors of the ampacity specified.

2. The lugs shall be marked with wire size, die index, number and location of crimps and shall be suitably color coded. Lug barrel shall be factory prefilled with a joint compound Listed by UL.
3. Using a suitable stripping tool, to avoid damage to the conductor, remove insulation from the required length of the conductor.
4. Clean the conductor surface using a wire brush.
5. Crimp the connection per the connector manufacturer's recommendation.
6. Wipe off any excess joint compound.

I. Termination of Aluminum Conductor to Aluminum Bus:

1. Prepare a mechanical connection conforming to F or G above.
2. Hardware:

   a. Bolts: Anodized aluminum alloy 2024-T4 and conforming to ANSI B18.2.1 and to ASTM B211 or B221 chemical and mechanical property limits.
   b. Nuts: Aluminum alloys 6061-T6 or 6262-T9 and conforming to ANSI B18.2.2.
   c. Washers: Flat aluminum alloy 2024-T4, Type "A" plain, standard wide series conforming to ANSI B27.2.
   d. Lubricate and tighten the hardware as per the manufacturer's recommendations.

J. Termination of Aluminum Conductor to Copper Bus:

1. Prepare a mechanical connection conforming to F or G above.
2. Hardware:

   a. Bolts: Plated or galvanized medium carbon steel; heat treated, quenched and tempered equal to ASTM A-325 or SAE grade 5.
   b. Nuts: Heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B.
   c. Washers: Steel; Type A plain standard wide series conforming to ANSI B27.2.
   d. Belleville conical spring washers: hardened steel, cadmium plated or silicone bronze.
   e. Lubricate and tighten the hardware as per the manufacturer's recommendations.

K. Termination of Aluminum Conductor to Equipment Not Equipped for Termination of Aluminum Conductor:

1. Prepare compression connection using an adapter Listed by UL for the purpose or by pigtailing a short length of suitable size of copper conductor to the aluminum conductor with a compression connector Listed by UL.
2. Provide an insulating cover over adapter body or the compression connector.
3. Terminate the adapter or the pigtail on to the equipment per manufacturer's recommendation.

## 3.7 IDENTIFICATION

A. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.8 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Apply Sleeve and Sleeve Seal where raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies. Sleeve and Sleeve Seal materials and installation requirements are specified in Division 26 Section "Common Work Results for Electrical."

3.9 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.10 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each feeder, and branch circuit.
2. Test continuity of each circuit.

**B.** Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 26 Section "Common Work Results for Electrical" to perform the following field tests and inspections and prepare certified test reports:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance conductors, and conductors of No. 2 AWG and larger for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for one minute.

D. Perform continuity test to insure correct cable connection.

E. Test Values

1. Bolt-torque levels shall be in accordance with Table 1.1 thru Table 1.4, unless otherwise specified by the manufacturer.

**Table 1.1** - Bolt Torque for Bus Connection using Cadmium or Zinc Plated Heat-Treated Steel

| Grade | SAE 1 & 2 | SAE 5 | SAE 7 | SAE 8 |
|---|---|---|---|---|
| Minimum Tensile (P.S.I.) | 64K | 105K | 133K | 150K |
| Bolt Diameter (Inches) | Torque (Foot Pounds) | | | |
| 1/4 | 4.0 | 5.6 | 8.0 | 8.4 |
| 5/16 | 7.2 | 11.2 | 15.2 | 17.6 |
| 3/8 | 12.0 | 20.0 | 27.2 | 29.6 |
| 7/16 | 19.2 | 32.0 | 44.0 | 48.0 |
| 1/2 | 29.6 | 48.0 | 68.0 | 73.6 |
| 9/16 | 42.4 | 70.4 | 96.0 | 105.6 |
| 5/8 | 59.2 | 96.0 | 133.6 | 144.0 |
| 3/4 | 96.0 | 160.0 | 224.0 | 236.8 |

| | | | | |
|---|---|---|---|---|
| 7/8 | 152.0 | 241.6 | 352.0 | 378.4 |
| 1 | 225.6 | 372.8 | 528.0 | 571.2 |

**Table 1.2** - Bolt Torque for Bus Connection using Silicon Bronze Fasteners [1]

| | Non-Lubricated | Lubricated |
|---|---|---|
| Bolt Diameter (Inches) | Torque (Foot Pounds) | |
| 5/16 | 15.0 | 10.0 |
| 3/8 | 20.0 | 14.0 |
| 1/2 | 40.0 | 25.0 |
| 5/8 | 55.0 | 40.0 |
| 3/4 | 70.0 | 60.0 |

[1] Bronze alloy bolts with minimum tensile strength of 70,000 pounds per square inch.

**Table 1.3** - Bolt Torque for Bus Connection using Aluminum Alloy Fasteners [2]

| | Lubricated |
|---|---|
| Bolt Diameter (Inches) | Torque (Foot Pounds) |
| 5/16 | 8.0 |
| 3/8 | 11.2 |
| 1/2 | 20.0 |
| 5/8 | 32.0 |
| 3/4 | 48.0 |

[2] Aluminum alloy bolts with minimum tensile strength of 55,000 pounds per square inch.

**Table 1.4** - Bolt Torque for Bus Connection using Stainless Steel Fasteners [3]

| | Uncoated |
|---|---|
| Bolt Diameter (Inches) | Torque (Foot Pounds) |
| 5/16 | 14.0 |
| 3/8 | 25.0 |
| 1/2 | 45.0 |
| 5/8 | 60.0 |
| 3/4 | 90.0 |

[3] Bolts, cap screws, nuts, flat washers, locknuts: 18-8 alloy. Belleville washers: 302 alloy.

a. Minimum insulation-resistance values shall be not less than 50 megohms.
b. Investigate deviations between adjacent phases.

2. Infrared Scanning: Perform Thermographic Survey in accordance with NETA ATS, Section 9.0.

a. Initial Infrared Scanning: Within 60 Days after Substantial Completion, perform an infrared scan of each termination of or splice in cables and conductors No. 3 AWG and larger. Open or remove doors and covers so connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each termination and splice 11 months after date of Substantial Completion.
c. Instruments, Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

d. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

F. Cables will be considered defective if they do not pass tests and inspections.

G. Correct Deficiencies, Retest and Report:

1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace conductors, units, and devices as required to bring system into compliance.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Prepare a written report, certified by testing agency, to record the following:

   a. Procedures used.
   b. Results that comply with requirements, identifying conductor, units, and devices checked.
   c. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
   d. Observations and test results after remedial action.

END OF SECTION 260519

# PART 1 - GENERAL

## 1.1 SUMMARY

A. NFPA 70 and IEEE C2 include basic grounding requirements for electrical safety. This Section supplements the minimum safety requirements of the Code with requirements for additional grounding and with optional grounding methods and materials for both power and electronic systems.

B. This Section includes methods and materials for grounding and bonding systems and equipment., plus the following special applications:

1. Common ground bonding with lightning protection system.

C. Related Sections include the following:

1. Division 26 Section "Lightning Protection for Structures" for common ground bonding with lightning protection system.
2. [Division 27 Section "Grounding and Bonding for Communications Systems" for common ground bonding of Communications Systems including grounding bus.]

## 1.2 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

B. Product Data: For each type of product indicated.

## 1.3 INFORMATIONAL SUBMITTALS

A. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. Grounding for sensitive electronic equipment.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control test reports.

## 1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For independent agency as defined in Division 26 Section "Common Work Results for Electrical".

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

D. Comply with NFPA 70.

E. Comply with NFPA 99.

F. Comply with IEEE C2.

G. Comply with ANSI-J-STD-607-A.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

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

1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

### 2.2 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. [Tinned Conductors: ASTM B 33.]

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Main Bonding Jumper: stranded copper conductors sized as indicated on Drawings.
8. Grounding Electrode Conductor: stranded copper conductors sized as indicated on Drawings.
9. Common Grounding Electrode Conductor: stranded copper conductors sized as indicated on Drawings.

2.3 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, long barrel with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING BUSBARS

A. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm in cross section, 20 inches (500 mm) in length, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V, unless otherwise indicated.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 inch (16 mm) diameter by 120 inches (3000 mm, unless otherwise indicated.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Insulated solid or stranded for No. 10 AWG and smaller, insulated stranded for No. 8 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 3/0 AWG minimum.

1. Bury at least 30 inches below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inch minimum, from wall 12 inches above finished floor or 6 feet above transformer, unless otherwise indicated.
2. Clean and apply anti-oxidant to the contact area prior to conductor connection.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location as indicated on the Drawings. The electrode shall be connected to the frame of the generator.

B. Dry-Type Transformers: Install an insulated grounding conductor from the common point of connection of the transformer secondary neutral point and the transformer enclosure to the following:

1. The nearest grounding electrode per NFPA 70, including but not limited to building steel where available.
2. The grounding bus of the common electrode grounding system, located in the electrical equipment room.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

1. Bond to each device, box, and luminaire, unless otherwise indicated.
2. Conduction insulation of the same rating as the phase conductors, for all feeders and branch circuits. Install the grounding conductors in the raceway with related phase and neutral conductors.
3. Where parallel conductors in separate raceways occur, provide a grounding conductor in each raceway that meets requirements of NFPA 70.

B. Enclosures: Install an insulated grounding conductor from grounding bushings to the frame of the enclosure, ground bus, and equipment grounding strap where each occurs. Install grounding bushings on all raceways connecting electrical enclosures constructed of separate enclosure panels, which are not integrally welded together.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including but not limited to air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway. Terminate at grounding conductor terminal on isolated ground bus of equipment of the applicable derived system or service, unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway. Terminate at grounding conductor terminal on isolated ground bus of equipment of the applicable derived system or service, unless otherwise indicated.

3.5 INSTALLATION

A. Provide permanent service neutral and equipment grounding in accordance with NFPA 70 and subject to the following additional requirements.

B. Comply with mounting and support requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."

C. Connect the service neutral and equipment ground to a common point within the metallic enclosure containing the main service disconnecting means. Equipment grounds and the identified neutral of the wiring system shall not be interconnected beyond this point in the interior wiring system. From the common point of connection of the service neutral and the equipment ground, run in non-magnetic conduit a grounding electrode conductor without joint or splice to the grounding electrode system and connect it with an approved bolted pressure clamp.

D. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

E. Ground Rods: Drive rods until tops are 12 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor a minimum of 30-inches below grade unless otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least 6' from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

F. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
4. Where expansion joints or telescoping joints occur, provide bonding jumpers.

G. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes within 5' of point of entrance, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

3.6 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components as specified in Division 26 Section "Identification for Electrical Systems."

3.7 CONNECTIONS

A. Ground Connections: Provide ground clamps or connectors of a suitable type for ground applications.

B. Ground Bars: Irreversible bolted connector.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 26 Section "Common Work Results for Electrical" to perform the following field tests and inspections and prepare certified test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

   a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Tests for patient-care areas: In addition to the test listed above, perform additional field tests and inspections for patient care areas. Patient care areas are defined by the LAHJ.

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements. Perform the following tests:

a. Impedance: Measurement shall be made between the reference point and the grounding contact of all receptacles in the patient care room. The maximum limit allowed is 0.1 ohms.
b. Voltage: Measurement shall be made under no-fault conditions between a reference point and all exposed fixed electrical equipment with conductive surfaces in the patent care vicinity, including but not limited to: overbed wall-mounted fixtures, ceiling mounted exam lights, sensor faucets, etc. The maximum limit allowed is 20mV.

2. Prepare certified test reports in compliance with NFPA 99 and submit reports in conjunction with field quality control reports required in Division 26 Section "Wiring Devices". Utilize the Patient Care Area Electrical Testing Form in the Appendix of this section for each patient care area.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

1. Report measured ground resistances that exceed the following values:

a. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
b. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
c. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
d. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
e. Substations and Pad-Mounted Equipment: 5 ohms.
f. Manhole Grounds: 10 ohms.

F. Correct Deficiencies, Retest and Report:

1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace conductors, units, and rods as required to bring system into compliance.
2. Prepare a written report, certified by testing agency, to record the following:

a. Procedures used.
b. Results that comply with requirements, identifying components checked.
c. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
d. Observations and test results after remedial action.

END OF SECTION 260526

# APPENDIX

## PATIENT CARE AREA ELECTRICAL SYSTEM INSPECTION / TESTING FORM

DATE: _____

ROOM NO: _____ LOCATION: _____

INSPECTED BY: _____ INSTRUMENTATION: _____

| Room Rcpt. No. | Mechanical Condition | Wiring / Polarity | Contact Tension | | | Voltage | | GFCI Trip | Ground Potentials (millivolts) | Ground Re-sistance (Ohms) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | H | N | O | H-N | N-O | | | |
| | | | | | | | | | | |
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REMARKS: _____

REFERENCE POINTS: _____ (mark on sketch)

ROOM LAYOUT SKETCH

END OF APPENDIX

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Division 26 Section "Vibration And Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

## 1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. RAC: Rigid aluminum conduit.

E. RMC: Rigid metal conduit.

F. RNC: Rigid nonmetallic conduit.

G. RSC: Rigid Steel conduit.

## 1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, using performance requirements and design criteria indicated.

1. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

## 1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

## 1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. 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:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Atkore International.
g. Wesanco, Inc.

2. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Device Box Mounting Brackets and Stabilizer: Factory-fabricated sheet steel brackets for support of device boxes adjacent to or between studs.

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

a. Cooper B-Line, Inc.
b. ERICO International Corporation.

F. Through-Stud Cable and Raceway Support Clips: Factory-fabricated spring steel clip for cables or raceways where run horizontally through metal studs.

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

a. Cooper B-Line, Inc.
b. ERICO International Corporation.

G. Roof-mounted Raceway Support Blocking: Factory-fabricated support blocking for use under roof-mounted raceways. Wedge-shaped blocking constructed of 100% recycled UV-resistant Rubber with integral galvanized steel strut to accept raceway support clips.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Cooper B-Line C-Port series components or a comparable product by one of the following:

a. Cooper B-Line, Inc.
b. ERICO International Corporation.

H. Tee Bar Grid Box Hanger: Factory-fabricated metal electrical box hanger for supporting boxes at locations between ceiling system t-grid components. Height adjustable for various electrical box depths. Attached to ceiling tee bar with screws or integral clamp for stability. Includes tab for independent support wire attachment.

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

a. Cooper B-Line, Inc.
b. ERICO International Corporation.

I. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

J. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

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

1) Cooper B-Line, Inc.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti, Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Solid, threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NFPA 70, NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except where requirements of this Section are more stringent.

B. Maximum Horizontal and Vertical Support Spacing for Raceway(s): Space supports for EMT, IMC, and RMC as required by NFPA 70.

C. Minimum Hanger Rod Size for Raceway Supports: Minimum rod size shall be 1/4 inch (6 mm) in diameter.

D. Single Raceways or Cables:

1. For Raceways 1-1/4-inch (32mm) and smaller: Install adjustable steel band hanger suspended on threaded rod.
2. For Raceways larger than 1-1/4-inch (30mm): Install trapeze-type supports fabricated with steel slotted support system suspended on threaded rods. Size trapeze members, including the suspension rods, based on the support required for the size, and loaded weight of the conduits.

   a. Secure raceway or cable to support with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system suspended on threaded rods, where multiple raceways are run vertically or horizontally at the same elevations. Size trapeze members, including the suspension rods, based on the support required for the number, size, and loaded weight of the conduits. Space them as required for the smallest conduit to be supported. Size so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

G. Corrosive Areas: Provide non-metallic slotted support systems for supports installed in corrosive areas. Corrosive areas include, but are not limited to the following:

1. Within 25-feet (7.62-m) of Cooling Towers and Air Cooled Chillers.

3.2 SUPPORT INSTALLATION

A. Comply with NFPA 70, NECA 1 and NECA 101 for installation requirements except where requirements of this Article are more stringent.

B. Fasten junction, pull and devices boxes securely to the building construction, independent of raceway system.

C. Install Device Box Mounting Brackets supported between two studs where boxes are not located adjacent to stud or where multiple boxes are located between studs.

D. Device Box shall not be supported by a single stud, but shall be positively attached to a support device between studs.

E. Install Through-Stud Cable and Raceway Support Clips where cables or raceways run horizontally through metal studs.

F. Install Tee Bar Grid Box Hanger supported between two ceiling grid tee bars where devices boxes are located flush in recessed suspended ceilings.

1. Install at least one independent support rod from box hanger to structure.

G. Install Roof-mounted Raceway Support Blocking where raceways run on across roofing.

1. Coordinate installation of roof supports with items specified in Division 07 Section "Roof Accessories." Provide products compatible with rooftop materials included in the Work.

H. Provide minimum of two lock nuts per threaded support rod except where lock nut tightens against a threaded socket, one locknut may be used.

I. Support raceways at a distance above suspended ceilings to permit removal of ceiling panels and luminaires.

J. Locate raceways so as not to hinder access to mechanical equipment.

K. Do not secure conductors, raceways, or supports to suspended ceiling hanger rods or wires.

L. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

M. Mounting and Anchorage of Surface-Mounted or Recessed-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts. Where support anchors are required, establish their type and locate in concrete construction before concrete is poured, if possible. Fit each hanger rod with a nut at its upper end, and set nut in a universal concrete insert in the form. Where supported weight exceeds holding strength of a single insert, pass rods through top slot of inserts and interlock with reinforcing steel. Also, where particularly heavy loads are to be supported, suspend hanger rod or rods from a structural angle spanning two or more inserts and securely bolted thereto to distribute the weight.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
6. To Light Steel: Sheet metal screws.
7. For Surface-Mounted Items on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to structure by means that meet seismic-restraint strength and anchorage requirements. Attachment to gypsum wall board is not acceptable as sole support means; slotted-channel rack solidly attached to structure or light-gauge metal framing at both ends is required.
8. For Recessed-Mounted Items in Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices to intermediate light-gauge metal framing members on each side of device or provide slotted-channel racks within hollow wall attached to structure by means that meet seismic-restraint strength and anchorage requirements. Attachment to gypsum wall board is not acceptable as sole support means.

N. Do not support any items (equipment, piping, conduit, etc.) exceeding 2 inches in diameter from the bottom of slabs. Where intermediate supports are required between structural members, use slotted steel channels support systems attached to beams or joists in order to avoid attachment to slabs.

O. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars. Verify reinforcing locations with Structural Engineer. X-Ray existing concrete structures as required.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 3 inches larger in all directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

D. All floor mounted equipment shall be provided with concrete base, unless otherwise indicated.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes:

1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Surface raceways.
4. Boxes, enclosures, and cabinets.

B. Provide raceways and boxes for all the other systems, as specified in other Sections of Divisions 26, 27 and 28.

## 1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical non-metallic tubing.

C. EPC: Electrical Plastic Conduit

D. EPDM: Ethylene-propylene-diene terpolymer rubber.

E. FMC: Flexible metal conduit.

F. IMC: Intermediate metal conduit.

G. LFMC: Liquidtight flexible metal conduit.

H. LFNC: Liquidtight flexible nonmetallic conduit.

I. NBR: Acrylonitrile-butadiene rubber.

J. RAC: Rigid aluminum conduit.

K. RMC: Rigid metal conduit.

L. RSC: Rigid Steel conduit.

## 1.3 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

C. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1.4 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store raceway components indoors to prevent water or other foreign materials from staining or adhering to components. Unpack and dry wet materials before storage.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

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

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. FSR Inc.
6. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
7. Patriot Aluminum Products, LLC.
8. Picoma Industries.
9. Republic Conduit.
10. Robroy Industries.
11. Southwire Company.
12. Thomas & Betts Corporation.
13. Western Tube and Conduit Corporation.
14. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RSC: Comply with ANSI C80.1, UL 6, and NEMA FB 2.10; Galvanized rigid steel, each length with a coupling on one end and thread protector on opposite end. Color-coded from factory, refer to Part 3 "Conduit Color Table."

D. IMC: Comply with ANSI C80.6, UL 1242, and NEMA FB 2.10. Color-coded from factory, refer to Part 3 "Conduit Color Table."

E. Fittings for RSC and IMC: Provide factory made threaded couplings of same material as the conduit.

1. Molded thermoplastic insulating bushing at all boxes and cabinets, with locknuts inside and outside box or cabinet. In wet locations, provide watertight hubs for conduit entry into enclosures.
2. Thermoplastic insulated grounding bushing on all conduits where grounding bushings are required, with locknuts inside and outside the enclosure. In wet locations provide watertight hubs for conduit entry into enclosures.
3. Expansion joints: O-Z/Gedney or acceptable submission, with internal ground and external bonding jumper.

a. Expansion fitting: Type AX.
b. End type expansion fitting: Type EXE.
c. Deflection fitting: Type DX.
d. Pull box fitting: Type EXPB.
e. Combination expansion/deflection fitting: Type AXDX.

F. Conduit fittings for Hazardous (Classified) Locations: Comply with UL 886.

G. PVC-Coated Steel Conduit: Comply with NEMA RN 1 and ETL PVC-001; PVC-coated RSC or IMC with 0.040 inch, minimum coating thickness. Color-coded from factory, refer to Part 3 "Conduit Color Table."

H. Coating for fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

I. EMT: ANSI C80.3 and UL 797. Color-coded from factory, refer to Part 3 "Conduit Color Table."

J. Fittings for EMT:

1. Steel, set-screw couplings.
2. Steel, set-screw insulated throat box connectors with molded thermoplastic insulating bushing at all boxes and cabinets, with locknuts inside box or cabinet.
3. Steel, set-screw insulated throat box connectors with thermoplastic insulated grounding bushing on all tubing where grounding bushings are required.
4. Expansion joints: O-Z/Gedney, type TX or acceptable submission, with internal ground and external bonding jumper.
5. Insulated throat material for fittings to be of a color that is easily distinguishable; clear thermoplastic throats are not acceptable.

K. FMC: Comply with UL 1; Zinc-coated steel. Color-coded from factory, refer to Part 3 "Conduit Color Table."

L. LFMC: Comply with UL 360; Flexible steel conduit with flame retardant PVC jacket and copper grounding strand. Color-coded from factory, refer to Part 3 "Conduit Color Table."

M. Fittings for FMC and LFMC: Comply with NEMA FB 1 and UL 514B.

a. Adapters at connections between flexible and rigid conduit.
b. Thermoplastic insulated throat, steel connectors at box or cabinet terminations.
c. Insulated throat material for fittings to be of a color that is easily distinguishable; clear thermoplastic throats are not acceptable.

N. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

O. Wire Support Bushings: Provide for vertical runs as required by the NFPA 70. Select for the conductor size involved.

1. For conductors NO. 8 AWG and smaller provide galvanized, non-insulating type.
2. For conductors No. 6 AWG and larger provide O-Z/Gedney, Type SR, insulating type.

P. Joint Compound for RSC or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

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

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Mono-Systems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, type and sized according to NFPA 70 as required.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 870.

D. Fittings and Accessories:

1. Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
2. Construct wireways with/without knockouts, as required.
3. Provide spring nuts or guards on all screws installed toward the inside to prevent wire insulation damage.

E. Wireway Covers:

1. Hinged type unless access restrictions require screw-cover type.
2. Flanged-and-gasketed as required for NEMA type.
3. Construct cover to close without the use of parts other than the standard lengths, fittings, and connectors.
4. Provide provisions for the cover to be sealed in the closed position with a sealing wire.

F. Finish: Manufacturer's standard enamel finish.

2.3 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers, complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

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

a. Hubbell Incorporated; Wiring Device-Kellems.
b. MonoSystems, Inc.
c. Panduit Corp.
d. Wiremold / Legrand.

C. Surface raceways used together with couplings, clips, bushings, straps, connectors, connection covers, elbows, boxes, extension boxes, fixture boxes, extension adapters, blank covers and all other required fittings; size to accommodate the conductors to be installed therein in each case.

2.4 BOXES, ENCLOSURES, AND CABINETS

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

1. Adalet.
2. Cooper Technologies Company.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman; a brand of Pentair Equipment Protection.
7. Hubbell Incorporated.
8. Kraloy.
9. Milbank Manufacturing Co.
10. MonoSystems, Inc.
11. Oldcastle Enclosure Solutions.
12. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
13. RACO; Hubbell.
14. Robroy Industries.
15. Spring City Electrical Manufacturing Company.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Floor Boxes: Nonadjustable, round.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Sheet Metal Pull and Junction Boxes: Comply with NEMA OS 1.

1. Construct boxes from code gauge sheet steel no lighter than 14 gauge with overlapped riveted or welded corners and with edges turned to receive trim.
2. Construct covers from same gauge as box with screw fasteners. Sectionalize boxes over 864 square inches.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Gangable boxesare allowed, except for receptacles in patient care area.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

M. Cabinets:

1. Comply with NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Above Ground: RSC, or IMC.
2. Within Crawl Spaces: RSC, or IMC.
3. Emergency Feeders: RSC
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R, unless otherwise indicated.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Physical Damage: RSC, or IMC. Includes, but is not limited to, raceways in the following locations:

a. Loading dock.
b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
c. Mechanical rooms.

3. Conductors over 600 volts: RSC, or IMC.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Concealed within Masonry Walls: RSC, or IMC.
6. Concealed under Raised Floors: EMT or LFMC.
7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
8. Flexible Connection to Luminaires on Normal System: FMC, maximum of 72 inches (1830 mm).

**1.** Connection to Luminaires on Essential/Emergency System: RSC, IMC, or EMT. Flexible Connection to Luminaires on Emergency System: FMC, maximum of 72 inches (1830 mm).

2. Damp or Wet Locations: RSC, or IMC.
3. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel indamp or wet locations.
4. Emergency feeders and branch circuits: EMT.
5. Corrosive Locations: PVC-Coated RSC, PVC-Coated Steel Conduit.

C. Conduit Color Table:

1. Color code conduit in accordance with current facility standard. Where no standard exists for color-coding, provide in accordance with Conduit Color Table below.

| Conduit Color Table | |
|---|---|
| Conduit Service | Color Description |
| Building Automation and Controls | Blue |
| Fire Alarm | Red |
| Life Safety Power Branch | Yellow |
| Critical Power Branch | Orange |
| Equipment Branch | Green |

D. Minimum Raceway Size:

1. Individual Branch Circuits: [1/2-inch(16-mm)] [3/4-inch(21-mm)].
2. For feeder circuits and multiple branch circuits: 3/4-inch

E. Provide minimum 1/2"-inch(16-mm) conduit for controls circuiting.

F. Use the shortest path possible to the intended load or receptacle for raceways of ungrounded circuits which are electrically monitored by ground detector system; this is intended to minimize leakage current to ground. In ceiling space, utilize paths that deviate from that perpendicular to structure where these paths will not interfere with other overhead systems.

G. Junction and Pull Boxes: Sheet steel boxes, unless otherwise indicated.

1. Provide boxes no smaller than 4 inches square and 2-1/8 inches deep.
2. Size all junction and pull boxes in accordance with the NFPA 70, unless project conditions dictate use of larger boxes.
3. Boxes in Hazardous Areas: Cast metal boxes with appropriate sealing fittings.

H. Outlet and Device Boxes: Sheet steel boxes, unless otherwise indicated.

1. For Lighting Fixture Outlets: 4 inch square with raised fixture ring.
2. For Wall Switches, Receptacles, and Communication Use: 4 inch square, one-piece. Use boxes with plaster rings in all plastered walls where wall thickness permits. Use boxes 1-1/2 inch deep only in locations where deep boxes cannot be accommodated by construction.
3. Boxes in Hazardous Areas: Cast metal boxes with appropriate sealing fittings.

I. Boxes Used Outdoors or in Damp/Wet Locations: Cast metal boxes with gasketed covers and threaded hubs.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Store conduit in dry locations during construction. Swab conduits out prior to pulling conductors.

C. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel, unless intumescent putty pads are installed according to Division07 Section "Penetration Firestopping."

D. Locate boxes so that cover or plate will not span different building finishes.

E. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

F. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

G. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

H. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

I. Recessed Boxes in Fire-Rated Partitions: For boxes located on opposite sides of same partition do not install boxes back-to-back; separate boxes with a minimum of 24 inch separation, unless otherwise indicated in the installation requirements specified in Division 07 Section "Penetration Firestopping."

J. Recessed Boxes in partitions around Acoustically-Sensitive Spaces: For boxes located on opposite sides of same partition do not install boxes back-to-back; separate boxes with a minimum of 24 inch separation. Acoustically-Sensitive Spaces include, but are not limited to, the following:

1. Conference Rooms, Meeting rooms and similar spaces.
2. Classrooms, Training Rooms and similar spaces.
3. Interview Rooms, Consultation Rooms and similar spaces.
4. Auditoriums, Lecture Rooms, and similar spaces.
5. Ballrooms, Private Dinning, and similar spaces.

6. Other spaces specifically listed in the Project Acoustic Consultants' recommendation reports or specifications.

K. On concealed conduit systems where boxes are not otherwise accessible, set boxes flush with finished surfaces for access, and provide overlapping covers.

L. Provide boxes where shown and where necessary for the installation and pulling of cables and wires.

M. Install covers on junction boxes and conduit bodies after wiring and connections are completed.

N. Install raceways perpendicular or parallel to building surfaces with boxes set plumb and square. In areas where there are no suspended ceilings, run all conduits parallel and perpendicular to building surface planes.

O. Install conduits to prevent excessive strain or damage to conductors.

P. Run conductors over 48 Volts in raceway, unless otherwise indicated.

Q. Where raceways are installed running parallel with flues, steam pipes, hot-water pipes, and other objects operating at high temperatures, maintain a minimum of 6 inches (150 mm) between raceway and pipe insulation or jacket.

R. Where raceways cross hot water and steam piping, maintain a minimum of 1-inch (25.4-mm) between raceway and pipe insulation or jacket. Install horizontal raceway runs above water and steam piping.

S. Complete raceway installation before starting conductor installation.

T. Support raceways and boxes as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

U. Conceal conduit within finished walls, ceilings, and raised floors, unless otherwise indicated.

V. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

1. Change from ENT to [**RAC,**] RSC, or IMC before rising above the floor.

W. No feeders or branch circuits are to be installed in any slab, unless otherwise indicated.

X. No branch circuits are to be installed below slab-on-grade, unless otherwise indicated. Exception: On-grade floor boxes, route raceway minimum of 6 inches below slab-on-grade.

Y. Do not install aluminum conduits in contact with concrete.

Z. Install no more than the equivalent of three 90-degree bends and a maximum of 150 feet between pull points in any conduit run except for communications conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

AA. Join RSC and IMC with threaded couplings. Ream conduits after threading and keep each end closed.

BB. Join EMT with the specified type of couplings. At EMT terminations, provide insulated throat, box connectors and locknuts.

CC. Provide insulating bushing at conduit box terminations. Provide bonding clamps where grounding bushings are required.

DD. Secure rigid conduits at cabinets and boxes with galvanized locknuts, both inside and outside.

EE. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

FF. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

GG. Surface Raceways:

1. Install surface raceway with a minimum 2-inchradius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

HH. Install raceways to avoid moisture traps. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. In damp or wet locations.
4. Where otherwise required by NFPA 70.

II. Install raceways and cables as to not hinder access to ceiling space through access hatches. Maintain 36" minimum clearance and required clearance to equipment above ceiling access hatches.

JJ. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

KK. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.

c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

LL. Flexible Conduit Connections: Comply with NEMA RV 3.

1. Use minimum of 12 inches (305 mm) and a maximum of 72 inches (1830 mm) at final connections to equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
2. Use LFMC in damp or wet locations including mechanical equipment rooms, at motor or equipment locations at or near pumps, and when installed outdoors.

MM. Where raceways do not terminate in a box or cabinet, install thermoplastic insulating bushings on end of raceway to protect future cabling from physical damage.

NN. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

OO. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

PP. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

QQ. Install pull wires free of splices in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Coil and identify each end of each line with plastic tag bearing complete information as to the purpose of the raceway and the location of its other end.

## 3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Apply Sleeve and Sleeve Seal where raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies. Sleeve and Sleeve Seal materials and installation requirements are specified in Division 26 Section "Common Work Results for Electrical."

## 3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

## 3.5 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.6 CONNECTIONS

A. Ground raceways and boxes according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Identify raceways and boxes as specified in Division 26 Section "Identification for Electrical Systems".

3.8 SEGREGATION OF WIRING SYSTEMS

A. Segregation of wiring systems shall not be compromised by the use of common pullboxes, wireways, cabinets or any other type of enclosure.

B. The raceway system for each feeder shall be a separate system completely fault isolated from all other raceway systems.

C. The raceway system for the branch circuits of each panelboard shall be a separate system completely fault isolated from all other raceway systems.

D. In systems operating at more than 300 volts between phase conductors, and where different phase conductors are to be run to a common device or outlet box, provide code gauge barrier equal to box gauge between conductors so that two different phase wires will not be in the same compartment.

3.9 CLEANING

A. On completion of raceway installation but before any cable is installed, perform the following:

1. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. On completion of box, enclosure, and cabinet installation but before any cable or wiring devices are installed, inspect interior of boxes and perform the following:

1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 260533

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes:

1. Raceways, fittings, boxes, enclosures, and cabinets for special systems wiring.
2. Non-continuous Angle Bracket Cable Supports (J-Hooks) for special systems wiring.
3. Aluminum cable trays and accessories for special systems wiring.

B. Related Sections include the following:

1. Division 26 Section "Raceways and Boxes for Electrical Systems" for raceways, fittings, boxes, enclosures, and cabinets for electrical wiring and for product requirements for common products referenced by this Section.

## 1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. EPC:Electrical Plastic Conduit

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RAC: Rigid aluminum conduit.

J. RMC: Rigid metal conduit.

K. RSC: Rigid Steel conduit.

L. Special Systems:

## 1.3 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under

# PART 2 - PART 2 - PRODUCTS.

A. Product Data: Include data indicating dimensions and finishes for each of the following:

1. Conduit, tubing, surface raceways, wireways and fittings.
2. Angle Brackets (J-Hooks), Wide-Base Cable Supports, and Adjustable Cable Support Straps.
3. Cable trays.

2.2 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit Coordination Drawings in accordance with Division 26 Section "Common Work Results for Electrical". Include the following:

1. Pathway routing plans, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

a. Proposed path for raceways, including sizes and location of cable pull points.
b. Structural members in the paths of raceways, cabling support brackets and cable trays.
c. HVAC, plumbing items, and architectural features in the paths of raceways, cabling support brackets and cable trays. Denote where systems share common supports.
d. Vertical and horizontal offsets and transitions in pathway route.
e. Clearances for access above and to side of cabling support brackets and pathways.
f. Vertical elevation of cabling support brackets and cable trays above the floor or bottom of ceiling structure.

B. Field quality-control reports.

2.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pathway components to include in emergency, operation, and maintenance manuals.

2.4 QUALITY ASSURANCE

A. Source Limitations: Obtain pathway components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

2.5 DELIVERY, STORAGE, AND HANDLING

A. Store pathway components indoors to prevent water or other foreign materials from staining or adhering to components. Unpack and dry wet materials before storage.

1. Cable tray shall be loosely stacked, elevated off the floor, and ventilated to prevent staining during storage.
2. Aluminum cable tray shall be stored to prevent water or other foreign materials from staining or adhering to cable tray.

PART 3 - PRODUCTS

3.1 METAL CONDUIT, TUBING, AND FITTINGS

A. Refer to and comply with product specifications included in Division 26 Section "Raceways and Boxes for Electrical Systems" for conduit, tubing, and associated fittings and accessories.

3.2 BOXES, ENCLOSURES, AND CABINETS

A. Refer to and comply with product specifications included in Division 26 Section "Raceways and Boxes for Electrical Systems" for boxes, enclosures, cabinets, covers, and associated fittings and accessories.

3.3 SURFACE RACEWAYS

A. Refer to and comply with product specifications included in Division 26 Section "Raceways and Boxes for Electrical Systems" for surface raceways, covers and associated fittings and accessories.

3.4 WIRE-BASKET CABLE TRAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chalfant Manufacturing Company.
2. Chatsworth Products, Inc.
3. Cooper B-Line, Inc.
4. Cope, T. J., Inc.; a subsidiary of Allied Tube & Conduit.
5. GS Metals Corp.; GLOBETRAY Products.
6. MONO-SYSTEMS, Inc.
7. MPHusky.
8. PW Industries.

B. Description:

1. Configuration: Wires are formed into a standard 2-by-4-inch wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along entire length of section.
2. Materials: High-strength-steel longitudinal wires with no bends.
3. Safety Provisions: Wire ends along wire-basket sides (flanges) rounded during manufacturing to maintain integrity of cables and installer safety.
4. Sizes:

   a. Straight sections shall be furnished in standard 118-inch lengths.
   b. Wire-Basket Depth: 1-inch usable loading depth by 4 inches wide.
   c. Wire-Basket Depth: 2-inch usable loading depth by 12 inches wide.
   d. Wire-Basket Depth: 4-inch usable loading depth by 18 inches wide.
   e. Wire-Basket Depth: 6-inch usable loading depth by 24 inches wide.

5. Connector Assemblies: Bolt welded to plate shaped to fit around adjoining tray wires and mating plate. Mechanically joins adjacent tray wires to splice sections together or to create horizontal fittings.
6. Connector Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

7. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316.

3.5 NON-CONTINUOUS ANGLE BRACKET CABLE SUPPORTS (J-HOOKS)

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

1. Chatsworth Products, Inc.
2. ERICO International Corporation.
3. Panduit.

B. Sizes and Configurations: Refer to the Drawings for specific requirements for types, sizes, and configurations.

C. Individual Non-continuous Angle Bracket Cable Supports: Angle Bracket, Fittings, and Accessories:

1. Bearing Surface Width: sufficient width to comply with required bend radii of high-performance cables.
2. Edges: flared, to prevent damage while installing cables.
3. Cable Retainer Strap: Supports sized 1 5/16" and larger, provide a cable retainer strap for containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
4. Materials and Finishes: Electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments. Stainless Steel, intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.
5. Connectors: Manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips and treaded rod suspension accessories.

D. Multi-tiered Non-continuous Angle Bracket Cable Supports: Angle Bracket, Fittings, and Accessories:

1. Bearing Surface Width: sufficient width to comply with required bend radii of high-performance cables.
2. Edges: flared, to prevent damage while installing cables.
3. Cable Retainer Strap: Supports sized 1 5/16" and larger, provide a cable retainer strap for containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
4. Materials and Finishes: Electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
5. Connectors: Manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips and treaded rod suspension accessories.
6. Bracket Assembly: Steel angled hanger bracket holding up to six individual non-continuous cable supports. Multi-tiered non-continuous angle bracket cable support assemblies shall be used where separate cabling compartments are required. Factory-assembled or field-assembled from pre-packaged kits.

3.6 WARNING SIGNS

A. Lettering: 1-1/2-inch-high, black letters on yellow background with legend "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."

B. Materials and fastening are specified in Division 26 Section "Identification for Electrical Systems."

3.7 SOURCE QUALITY CONTROL

A. Perform design and production tests according to NEMA VE 1.

PART 4 - EXECUTION

4.1 APPLICATION

A. Pathways for Optical Fiber or Communications Cable. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed and Subject to Physical Damage: RSC. Includes, but is not limited to, raceways in the following locations:

a. Loading dock.
b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
c. Mechanical rooms.

2. Concealed within Masonry Walls: RSC, or IMC.
3. Damp or Wet Locations: RSC.
4. Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway.
5. Concealed in wall or partition cavities: EMT to the nearest accessible ceiling area.
6. Concealed ceiling spaces: EMT.
7. Exposed ceiling spaces (i.e. open structure): Plenum-type cable in Cable Tray.
8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

B. Minimum Raceway Size:

1. Optical Fiber or Communications Cable: 3/4-inch(21-mm
2. Controls Cable: 3/4-inch

4.2 INSTALLATION

A. Comply with NECA 1 and NECA 101vfor installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Comply with ANSI/EIA/TIA Standards 568 & 569,

C. Comply with NFPA 70.

D. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

E. Comply with installation requirements for raceways and boxes in Refer to Division 26 Section "Raceways and Boxes for Electrical Systems" for products.

F. Where raceways do not terminate in a box or cabinet, install thermoplastic insulating bushings on end of raceway to protect future cabling from physical damage.

G. Install a blank cover plate on all outlet boxes.

H. Install pull wires free of splices in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Coil and identify each end of each line with plastic tag bearing complete information as to the purpose of the raceway and the location of its other end.

I. Install fire-rated plywood backboards as indicated in locations where special systems equipment is located. Backboards shall be mounted six (6") inches AFF and extend upward a full eight (8'-0") feet.

J. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. Install raceways in maximum lengths of 75 feet between pull boxes.
2. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

K. Install individual raceways from special systems outlets boxes as follows, unless otherwise indicated:

1. Cables Concealed in wall or partition cavities to Concealed ceiling spaces: Route raceway in wall cavity to above nearest accessible ceiling. Extend raceway horizontally to within 12-inches of the cable pathway backbone.
2. Cables Concealed in wall or partition cavities to Exposed ceiling spaces: Route raceway in wall cavity to ceiling space and then turn horizontal and continue to the nearest cable pathway backbone or in conduit directly back to the termination room/closet for the special system.

4.3 OWNER FURNISHED SPECIAL SYSTEMS

A. Coordinate pathways, raceways and box requirements and details of special system installation with shop drawings produced by the Owner's selected vendor.

B. Vendor Furnished Boxes: Receive boxes from Owner's selected vendor and install in accordance with vendor shop drawings.

C. Contractor Furnished Boxes for Owner Furnished Special Systems: Refer to shop drawings produced by Owner's selected vendor and provide pathways, raceways and boxes in accordance with vendor shop drawings.

4.4 CABLE TRAY INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Comply with ANSI/ EIA/TIA Standards 568 & 569,

C. Comply with NFPA 70.

D. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

E. Comply with recommendations in NEMA VE 2. Install as a complete system, including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees, and crosses.

F. Remove burrs and sharp edges from cable trays.

G. Fasten cable tray supports to building structure and install seismic restraints.

1. Design each fastener and support to carry load indicated by seismic requirements and to comply with seismic-restraint details according to Division 16 26 Section Section "Vibration and Seismic Controls for Electrical Systems."
2. Place supports so that spans do not exceed maximum spans on schedules.
3. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
4. Support bus assembly to prevent twisting from eccentric loading.
5. Manufacture center-hung support, designed for 60 percent versus 40 percent eccentric loading condition, with a safety factor of 3.
6. Locate and install supports according to NEMA VE 1.

A. Support wire-basket cable trays with wall brackets.

B. Support center support hangers for wire-basket trays with 3/8-inch- diameter rods.

C. Make connections to equipment with flanged fittings fastened to cable tray and to equipment. Support cable tray independent of fittings. Do not carry weight of cable tray on equipment enclosure.

D. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA VE 1. Space connectors and set gaps according to applicable standard.

E. Make changes in direction and elevation using standard fittings.

F. Make cable tray connections using standard fittings.

G. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

H. Sleeves for Future Cables: Install capped sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

I. Workspace: Install cable trays with enough space to permit access for installing cables.

J. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

4.5 CABLE INSTALLATION

A. Install cables only when pathway installation has been completed and inspected.

B. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.

C. On vertical runs, fasten cables to tray every 18 inches. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

D. In existing construction, remove inactive or dead cables from pathways.

4.6 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Apply Sleeve and Sleeve Seal where raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies. Sleeve and Sleeve Seal materials and installation requirements are specified in Division 26 Section "Common Work Results for Electrical."

4.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

4.8 PROTECTION

A. Protect installed pathways.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
2. Install temporary protection for cables in pathways to protect exposed cables from falling objects or debris during construction. Temporary protection for cables and pathways can be constructed of wood or metal materials until the risk of damage is over.

4.9 CONNECTIONS

A. Ground cable trays according to manufacturer's written instructions.

B. Install an insulated equipment grounding conductor with cable tray, in addition to those required by NFPA 70.

C. Ground raceways and boxes according to Division 26 Section "Grounding and Bonding for Electrical Systems."

4.10 IDENTIFICATION

A. Identify raceways and boxes as specified in Division 26 Section "Identification for Electrical Systems".

4.11 FIELD QUALITY CONTROL

A. After installing pathway components and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:

1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in pathway components, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.
2. Verify that the number, size, and voltage of cables in pathways do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.
3. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.
4. Remove deposits of dust, industrial process materials, trash of any description, and any blockage of pathway ventilation.
5. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
7. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.

B. Report results in writing.

4.12 CLEANING

A. On completion of raceway installation but before any cable is installed, perform the following:

1. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. On completion of box, enclosure, and cabinet installation but before any cable or wiring devices are installed, inspect interior of boxes and perform the following:

1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 260553.13

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Identification for raceways.
2. Identification for conductors.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

B. Related Sections include the following:

1. Division 26 Section "Wiring Devices" for engraved wall plates and wiring device identification requirements.

## 1.2 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

B. Product Data: For each electrical identification product indicated.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

D. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

## 1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

## 1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Color for Raceways Carrying Circuit at 600V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type, if applicable.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING."

2.2 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Brass or Stainless Steel Wraparound Marker Labels: Cut from 0.014-inch-thick, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or Stainless Steel, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for interior application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for exterior application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR ## INCHES." Verify work space required for specific project conditions with NFPA 70 and replace "##" in previous sentence with appropriate distance.
3. Arc Flash Warning and Instructions: "WARNING – ARC FLASH AND SHOCK HAZARD. WEAR APPROPRIATE PPE. Determine appropriate protective clothing and personal protective equipment (PPE) for the task from NFPA 70E."

4. Provide detailed labeling in accordance with requirements listed in Division 26 Section "Overcurrent Protective Device Coordination Study".

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 ONE-LINE DIAGRAM NAMEPLATE

A. Preprinted engraved, laminated acrylic or melamine plastics sign. Nominal size, 12 by 12 inches1/8 inch (3.2 mm) thick. Engraved legend with black letters on white face. Image on sign depicting equipment components in single-line diagram format, using symbols and letter designations consistent with final one-line bus diagram. Produce a concise visual presentation of principal equipment components and connections.

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Adhesive, Punched, or drilled for screw mounting. Minimum letter height shall be 3/8 inch. Lettering and Background colors as indicated below:

a. Power Circuits:

1) Normal: White lettering on Black background.
2) Life Safety Branch: Black Lettering on Red background.
3) Critical Branch: Black lettering on Yellow background.
4) Equipment Emergency System: Yellow lettering on Blue background.
5) Non-Essential Emergency System: White lettering on Purple background.

b. Fire Alarm System: White lettering on Red background.
c. Fire-Suppression Supervisory and Control System: Yellow lettering on Red background.
d. Combined Fire Alarm and Security System: Red lettering on Blue background.
e. Security System: Blue lettering on Yellow background.
f. Mechanical and Electrical Supervisory System: Green lettering on Blue background.
g. Telecommunication System: Green lettering on Yellow background.
h. Control Wiring: Green lettering on Red background.
i. Nurse Call: White lettering on Black background
j. Public Address / Intercom: White lettering on Black background
k. CATV / MATV: White lettering on Black background
l. Clock: White lettering on Black background

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Conductor Color-Coding Key: Engraved, Laminated Acrylic, Melamine Label, or Decal-Style Label: Adhesive, Punched, or drilled for screw mounting. Minimum letter height shall be 3/8 inch. Key to describe the conductor color coding scheme used in building in accordance with NFPA 70.

2.9 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

D. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.

1. Exterior Ferrous Metal:

a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Exterior ferrous-metal primer.
2) Finish Coats: Exterior semigloss alkyd enamel.

2. Exterior Zinc-Coated Metal (except Raceways):

a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Exterior zinc-coated metal primer.
2) Finish Coats: Exterior semigloss alkyd enamel.

3. Interior Ferrous Metal:

a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Interior ferrous-metal primer.
2) Finish Coats: Interior semigloss acrylic enamel.

4. Interior Zinc-Coated Metal (except Raceways):

a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Interior zinc-coated metal primer.
2) Finish Coats: Interior semigloss acrylic enamel.

E. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Conductor Color-Coding Key: Install Instructional Label denoting the conductor color-coding scheme on all panelboards, distribution boards, switchboards, switchgear, motor-control center and similar equipment.

G. Conductor Color-Coding for Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied to conductors or for sizes larger than No. 8 AWG, if authorities having jurisdiction permit, field applied.
2. Colors for Grounding Conductors:

   a. Equipment Grounding Conductor: Green.
   b. Isolated Equipment Grounding Conductor: Green with Yellow Stripe.

3. Colors for 208/120-V Wye Systems:

   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
   d. Grounded Conductor (Neutral): White

4. Colors for 480/277-V Wye Systems:

   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Grounded Conductor (Neutral): Gray

5. Colors for Ungrounded Systems: Comply with applicable paragraphs of the current editions of NFPA 70 and NFPA 99.

   a. Conductor 1: Orange with a distinctive colored stripe other than white, green, or gray
   b. Conductor 2: Brown with a distinctive colored stripe other than white, green, or gray
   c. Conductor 3 (for three phase systems): yellow with a distinctive colored stripe other

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

K. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot (3-m) maximum intervals.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands every 10 lineal feet:

1. Fire Alarm System: Red.
2. Fire-Suppression Supervisory and Control System: Red and yellow.
3. Combined Fire Alarm and Security System: Red and blue.
4. Security System: Blue and yellow.
5. Mechanical and Electrical Supervisory System: Green and blue.
6. Telecommunication System: Green and yellow.
7. Control Wiring: Green and red.

C. Power-Circuit Conductor Identification, 600V or Less: Identify source and circuit number of each ungrounded conductor or set of conductors. For single conductor cables, identify phase in addition to the above.

1. For conductors in pull and junction boxes, device boxes, and within 6-inches (153 mm) of termination use pre-printed marker tape.
2. For conductors in vaults, manholes, hand holes and pull and junction boxes located in damp or wet locations use brass or stainless steel wraparound marker labels.

D. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.

b. Main-Tie-Main Switchboards
c. Generator Paralleling Switchgear.
d. Controls with external control power connections.

2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
3. Arc Flash Warning Labels: Apply label to door or cover at all access point of equipment including, but not limited to, the following:

a. Disconnect switches.
b. Electrical switchgear and switchboards.
c. Emergency system boxes and enclosures.
d. Enclosed circuit breakers.
e. Meter Sockets and assemblies.
f. Motor starters.
g. Panelboards.
h. Power transfer equipment.(ATS)
i. Transformers.

Available Fault Current Field Marking: Apply label to cover of existing and new service equipment enclosure with the date in which the fault current was calculated and the available fault currentas determined by the OCPD coordination study. Table1belowlistsatypicalexampleoflabelformat,coordinateprojectspecificrequirementswithDrawings.

Table 1 (Example Only)

| |
|---|
| MAX. AVAILABLE FAULT: XX,XXXA<br>DATE: X/X/XX |

H. Junction Boxes and Pull Boxes: Identify voltage, source, and circuit number(s) on cover of pull and junction boxes with hand-written legible block lettering using black permanent marking pen.

I. Color Coding of Junction Boxes and Pull Boxes: Identify system on cover of pull and junction boxes using colored enamel spray paint. Where two colors are indicated identify each half of box with colors indicated.

1. Power Circuits:

a. Normal: Black.
b. Emergency Legally Required Standby or Essential Electrical System prior to ATS: Black and Orange.
c. Emergency Optional Standby: Blue.
d. Life Safety Branch: Black and Red.
e. Critical Branch: Black and Yellow.
f. Equipment Emergency System: Yellow and Blue.
g. Non-Essential Emergency System: Purple.

2. Fire Alarm System: Red.
3. Fire-Suppression Supervisory and Control System: Red and yellow.
4. Combined Fire Alarm and Security System: Red and blue.
5. Security System: Blue and yellow.
6. Mechanical and Electrical Supervisory System: Green and blue.

7. Telecommunication System: Green and yellow.
8. Control Wiring: Green and red.

J. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer, load shedding.

K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where 3 lines of text or more are required, use label height as required to accommodate 3/8-inch-high letters.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label drilled and attached with corrosion-resistant screws.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor per ANSI A13.1.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Distribution Equipment with Overcurrent Protective Devices to be labeled:

a. Provide for each of the following and any other similar equipment furnished under this Division identification as to its given name, voltage, origination of service, branch, and amps rated interrupting. Table 2 below lists typical examples of label format, coordinate project specific requirements with Drawings:

1) Electrical switchgear and switchboards.
2) Panelboards.
3) Electrical substations.
4) Motor-control centers.
5) Enclosed switches.
6) Enclosed circuit breakers.

Table 2 (Examples Only)

| | | |
|---|---|---|
| EMERGENCY SYSTEM<br>'EMSA'<br>480Y/277V<br>FED FROM 'GEN-1'<br>RATED INTERRUPTING:<br>XX,XXXA | *NORMAL*<br>*'1DPHA'*<br>*480Y/277V*<br>*FED FROM 'MSA'*<br>RATED INTERRUPTING:<br>XX,XXXA | LIFE SAFETY BRANCH<br>'1LSHA'<br>480Y/277V<br>FED FROM 'DPLSHA'<br>RATED INTERRUPTING:<br>XX,XXXA |
| EQUIPMENT SYSTEM<br>'1EQLA'<br>208Y/120V<br>FED FROM 'T1EQLA' | *CRITICAL BRANCH*<br>*'1CRHA'*<br>*480Y/277V*<br>*FED FROM 'ATS-CR'* | *NON-ESSENTIAL*<br>*'1DPCH-N'*<br>*480Y/277V*<br>*FED FROM 'ATS-N'* |

| | | |
|---|---|---|
| RATED INTERRUPTING:<br>XX,XXXA | RATED INTERRUPTING:<br>XX,XXXA | RATED INTERRUPTING:<br>XX,XXXA |
| NORMAL<br>'CHP-1'<br>480Y/277V<br>FED FROM 'MCC-1'<br>RATED INTERRUPTING:<br>XX,XXXA | NORMAL<br>'AHU-1'<br>480Y/277V<br>FED FROM '1DPHA'<br>RATED INTERRUPTING:<br>XX,XXXA | *EQUIPMENT SYSTEM*<br>*'HWP-1'*<br>*480Y/277V*<br>*FED FROM 'CPEQHA'*<br>RATED INTERRUPTING:<br>XX,XXXA |

3. Distribution Equipment without Overcurrent Protective Devices to be labeled:

   a. Provide for each of the following and any other similar equipment furnished under this Division identification as to its given name, voltage, origination of service, and branch. Table 3 below lists typical examples of label format, coordinate project specific requirements with Drawings:

      1) Electrical cabinets, and enclosures.
      2) Enclosed Bus Assemblies.
      3) Transformers: Label that includes tag designation for the transformer, feed, and panelboards or equipment supplied by the secondary.
      4) Disconnect switches.
      5) Emergency system boxes and enclosures.
      6) Enclosed controllers.
      7) Variable-speed controllers.
      8) Push-button stations.
      9) Power transfer equipment (ATS) – Label both sources.
      10) Auxiliary Equipment (SPD, Capacitor Banks, etc.).
      11) Contactors.
      12) Fire-alarm control panel and annunciators.
      13) Uninterruptible power supply equipment.

Table 3 (Examples Only)

| | | |
|---|---|---|
| *CRITICAL BRANCH*<br>*'T2CLA'*<br>*75 KVA, 480V to 208Y/120V*<br>*FED FROM '2CHA'*<br>*FEEDS '2CRLA'* | *EQUIPMENT SYSTEM*<br>*'ATS EQ'*<br>*480Y/277V*<br>*FED FROM 'MSA' NORMAL*<br>*FED FROM 'EMSA'*<br>*EMERGENCY*<br>*FEEDS '1EQHA'* | *OPTIONAL STANDBY*<br>*SYSTEM*<br>*'ATS SS'*<br>*480Y/277V*<br>*FED FROM 'MSA' NORMAL*<br>*FED FROM 'EMSA'*<br>*EMERGENCY*<br>*FEEDS '1SSHA'* |

4. Other Equipment to be labeled:

   a. Provide for each of the following and any other similar equipment furnished under this Division identification as to its given name.

      1) Access doors and panels for concealed electrical items.
      2) Remote-controlled switches, dimmer modules, and control devices.
      3) Battery inverter units.
      4) Battery racks.
      5) Power-generating units, including remote emergency stop switches.

6) UPS equipment.
7) Voice and data cable terminal equipment.
8) Master clock and program equipment.
9) Intercommunication and call system master and staff stations.
10) Television/audio components, racks, and controls.
11) Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
12) Monitoring and control equipment.
13) Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

5. Provide for each feeder overcurrent protective device in each switchgear, switchboard, distribution panelboard, motor control center, and any other similar equipment furnished under this Division, identification as to the specific load that it serves.
6. Provide for each 3 phase motor: brass phase rotation tags securely attached to the equipment.

END OF SECTION 260553

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following lighting control devices:

1. Time switches.

2. Photoelectric switches.
3. Standalone daylight-harvesting switching controls.
4. Indoor occupancy sensors.
5. Outdoor motion sensors.
6. Lighting contactors.
7. Emergency shunt relays.

B. Related Sections include the following:

1. Division 26 Section "Wiring Devices" for wall-box dimmers, manual light switches, and timer wall-switches.

## 1.2 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

## 1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: These specifications and the accompanying Drawings define the intent of the lighting control system to be provided. The switches, sensors, control stations and switching group designations shown on the Drawings define how lighting should be grouped for control. Provide the necessary quantity and type of distributed control products necessary to achieve the design intent. In addition to the system as specified herein and shown on the Drawings, provide all planning, design, calculations, equipment, devices, cabling, system programming and any other component or service required for a complete, fully operational and code compliant system.

## 1.4 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

B. Product Data: For control modules, power distribution components, control network materials, manual switches and plates, and conductors and cables.

C. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

D. Delegated-Design Shop Drawings: Prepared by factory or authorized representative; based on devices proposed for inclusion in the Work. Include detail assemblies of standard components, custom assembled for specific application on this Project.

1. Floor Plans: showing all control stations, control devices, input devices, cabling, power sources, and other necessary equipment and components.
2. Control Station Legend: annotated to describe which stations shown in the Product Data are places at keyed locations.
3. Scene Schedules: schedule for each unique room type with scene descriptions.
4. System Riser: showing all components with their location labeled.
5. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
6. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
7. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
8. Interconnection diagrams showing field-installed wiring.
9. Dimensioned locations of occupancy and light-level sensors.
10. Coverage patterns for occupancy and light-level sensors.
11. Include diagrams for power, signal, and control wiring.

E. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 26 Section "Common Work Results for Electrical".

F. Product Certificates: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.

1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting control device, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:

1. Manufacturer's written instructions for adjusting devices after installation.

1.7 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including but not limited to luminaires, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. Invensys Controls.
4. Leviton Manufacturing Co., Inc.
5. Lithonia Lighting; Acuity Brands Lighting, Inc.
6. NSi Industries LLC; TORK Products.
7. Square D.
8. Tyco Electronics.
9. Watt Stopper.

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Contact Configuration: SPST, DPST, or DPDT, as indicated.
3. Contact Rating: 20-A ballast load, 120/277-V ac, and minimum of 30,000 switching cycles.
4. Programs: number of channels as indicated on Drawings; each channel shall be individually programmable with 40 on-off operations per week, plus 4 seasonal schedules that modify the basic program, and an annual holiday schedule that overrides the weekly operation on holidays; unless otherwise indicated.
5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
6. Astronomic Time: For Selected channels.

7. Automatic daylight savings time changeover.
8. Battery Backup and non-volatile memory for schedules and time clock, meeting the requirements of ASHRAE 90.1.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Eaton Corporation
3. Hubbell Building Automation, Inc.
4. Leviton Manufacturing Co., Inc.
5. Lithonia Lighting; Acuity Brands Lighting, Inc.
6. NSi Industries LLC; TORK Products.
7. Sensor Switch, Inc.
8. Square D.
9. Tyco Electronics.
10. Watt Stopper.

B. Description: Solid state, with SPST or DPST dry contacts as required, rated for 1800-VA tungsten or 1000-VA inductive to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off. Photocell may be integral with sensor.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 DAYLIGHT-HARVESTING SWITCHING CONTROLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Eaton Corporation
3. Hubbell Building Automation, Inc.
4. Leviton Manufacturing Co., Inc.
5. Lithonia Lighting; Acuity Brands Lighting, Inc.
6. Lutron Electronics Co., Inc.
7. NSi Industries LLC; TORK Products.
8. Sensor Switch, Inc.
9. Tyco Electronics.
10. Watt Stopper.

B. Ceiling-Mounted Switching Controls: Solid-state, light-level sensor unit, with separate power pack mounted on luminaire, to detect changes in indoor lighting levels that are perceived by the eye.

C. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Sensor Output: Contacts rated to operate the associated power pack, complying with UL 773A. Sensor is powered by the power pack.

4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. General Space Sensors Light-Level Monitoring Range: 10 to 200 fc, with an adjustment for turn-on and turn-off levels within that range.
6. Atrium Space Sensors Light-Level Monitoring Range: 100 to 1000 fc, with an adjustment for turn-on and turn-off levels within that range.
7. Skylight Sensors Light-Level Monitoring Range: 1000 to 10,000 fc, with an adjustment for turn-on and turn-off levels within that range.
8. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling.

9. Set-Point Adjustment: Equip with deadband adjustment of 25, 50, and 75 percent above the "on" set point, or provide with separate adjustable "on" and "off" set points.
10. Test Mode: User selectable, overriding programmed time delay to allow settings check.
11. Control Load Status: User selectable to confirm that load wiring is correct.
12. Indicator: Two digital displays to indicate the beginning of on-off cycles.

2.4 DAYLIGHT-HARVESTING DIMMING CONTROLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Hubbell Building Automation, Inc.
3. Leviton Manufacturing Co., Inc.
4. Lithonia Lighting; Acuity Brands Lighting, Inc.
5. Lutron Electronics Co., Inc.
6. Watt Stopper.

B. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.

1. Lighting control set point is based on two lighting conditions:

a. When no daylight is present (target level).
b. When significant daylight is present.

2. System programming is done with two hand-held, remote-control tools.

a. Initial setup tool.
b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.

C. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
4. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc.

2.5 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bryant Electric.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Manufacturing Co., Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Brands Lighting, Inc.
7. Lutron Electronics Co., Inc.

8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D.
12. Watt Stopper.

B. General Requirements for Sensors: Wall- or ceiling-mounting, solid-state indoor occupancy sensors with a power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the power pack.
3. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V ac/dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: Digital display, to show when motion is being detected during testing and normal operation of the sensor.
6. Detector Coverage: Occupancy sensor system shall cover the entire room or space served. Manufacturer selected for inclusion in the Work shall produce Delegated Design Shop Drawings with device layout and adjust sensor types or quantities as required by their specific products to provide complete coverage. Additional costs will not be considered for adjustments or device additions to meet performance requirements.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. **Dual-Technology Type:** Ceiling mounting; detect occupants in coverage area using PIR and ultra-sonic detection methods. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Comply with NEMA Standard LC 1-2007 "Test Procedures for Compatibility of Hearing Aids and Ultrasonic Lighting Control Devices".
2. Sensitivity Adjustment: Separate for each sensing technology.
3. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

D. Operation:

1. Vacancy Mode - Manual On/Off Auto Off: Turn lights on/off when manual switch is depressed. When covered area is unoccupied, turn lights off automatically; with a time delay, adjustable over a minimum range of 5 to 30 minutes.

   a. Manual override: Momentary contact low-voltage switch.

2.6 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bryant Electric.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Manufacturing Co., Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Brands Lighting, Inc.
7. Lutron Electronics Co., Inc.
8. NSi Industries LLC.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D.
12. Watt Stopper.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

C. Devices that are manufactured for use with modular plug-in connectors shall not be installed.

D. Wall-Switch Sensor:

1. Comply with NEMA Standard LC 1-2007 "Test Procedures for Compatibility of Hearing Aids and Ultrasonic Lighting Control Devices".
2. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area as required by application.
3. Sensing Technology: Dual technology - PIR and ultrasonic.

4. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off." Single circuit and dual circuit as required by Drawings.
5. Voltage: Match the circuit voltage.
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

E. Finishes, including device color, wall plate and lettering: Comply with Division 26 Section "Wiring Devices."

F. Wall Plates: Comply with wall plate requirements in Division 26 Section "Wiring Devices."

2.7 OUTDOOR MOTION SENSORS (PIR)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Lithonia Lighting; Acuity Brands Lighting, Inc.
3. Sensor Switch, Inc.

B. General Requirements for Sensors: Solid-state outdoor motion sensors.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. PIR type, weatherproof. Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. Comply with UL 773A.
3. Switch Rating:

   a. Lighting-Fixture-Mounted Sensor: 1000-W incandescent, 500-VA fluorescent.
   b. Separately Mounted Sensor: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.

4. Switch Type: SP, manual "on," automatic "off." SP, field selectable automatic "on," or manual "on" automatic "off."
5. Voltage: Match the circuit voltage.
6. Detector Coverage:

   a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft..
   b. Long Range: 180-degree field of view and 110-foot detection range.

7. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
8. Concealed, field-adjustable, "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.
10. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as "raintight" according to UL 773A.

2.8 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a business of Emerson Network Power.
3. Eaton Corporation.
4. General Electric Company.
5. Square D.

B. Description: Electrically operated and electrically held combination type with nonfused disconnect, unless otherwise indicated. Standard coil clearing contacts are to be provided so that the contactor coils shall be normally closed unless otherwise indicated. Contactor to comply with NEMA ICS 2 "Industrial Control Devices, Controllers, and Assemblies", UL 508 "Standard for Industrial Control Equipment", NEMA ICS 6 "Enclosures for Industrial Controls and Systems" and NFPA 70 "National Electrical Code".

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Contacts: Totally enclosed, double-break silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring. All contacts shall have clearly visible N.O. and N.C. contact status indicators.
3. Poles: As indicated on drawings.
4. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
5. Enclosure: Comply with NEMA 250 and ANSI/NEMA ICS 6, Type 1 or 3R, as required to meet conditions of installation.
6. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.
7. Wiring: Straight-through wiring with all terminals clearly marked.
8. Accessories:

   a. Selector Switch: HAND-OFF-AUTOMATIC
   b. Auxiliary Contacts: Two, normally open and normally closed, field convertible.

C. Interface with FMS System: Provide hardware interface to enable the FMS to monitor and control lighting contactors.

1. Monitoring: On-off status, Insert monitoring point.
2. Control: On-off operation,.

## 2.9 EMERGENCY SHUNT RELAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lighting Control and Design.
2. Watt Stopper.

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contact as indicated; complying with UL 924.

1. Coil Rating: 120-V or 277-V, as indicated.

## 2.10 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG or larger if otherwise required by manufacturer. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG or larger if otherwise required by manufacturer. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

## PART 3 - EXECUTION

### 3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

C. Switchbox-mounted sensors:

1. Set field selectable sensors to manual "on" automatic "off" for all devices indicated to be Vacancy sensors on the Drawings. Set all other sensors to field selectable automatic "on".
2. Comply with installation and connection requirements in Division 26 Section "Wiring Devices."

### 3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

B. Install in accordance with manufacturer's instructions.

### 3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

### 3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

C. Switchbox-mounted sensors: Comply with identification requirements in Division 26 Section "Wiring Devices."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following field tests and inspections and prepare certified test reports:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Time-Schedule Adjustments: Times indicated in documents represent initial settings known at time of design documentation. Coordinate final program settings for time-of-day and holiday schedules with Owner prior to Substantial Completion. When requested within 3 months of date of Substantial Completion, provide on-site assistance in adjust schedules to suit Owner. Provide up to one visit to Project during other-than-normal occupancy hours for this purpose.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. Reset all adaptive technology and learning devices post-construction.
2. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

3. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

3.7 CLEANING

A. Clean components according to manufacturer's written instructions.

B. On completion of device box installation but before any wiring devices are installed, inspect interior of boxes and perform the following:

1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

C. On completion of wall plate installation, inspect exterior surfaces and perform the following:

1. Remove paint splatters and other spots.
2. Replace cracked or damaged wall plates.
3. Wipe down all wall plates with approve cleaning agent to remove fingerprints and dust.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's management and maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 260923

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes service and distribution panelboards rated 600 V and less, including the following:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

B. Related Sections include the following:

1. Division 26 Section "Overcurrent Protective Device Coordination Study" for short-circuit rating of devices and for setting of overcurrent protective devices.
2. Division 26 Section "SPD for Low-Voltage Electrical Power Circuits" for internal surge protective devices.

C. Equipment specified in this Section includes distribution equipment for stand-alone mounting. Equipment specified in this Section shall not be installed as part of an Integrated Power System Switchboard.

## 1.2 DEFINITIONS

A. AFCI: Arc-fault circuit interrupter.

B. DPM: Multifunction Digital-Metering Monitor

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. GFEP: Ground-fault equipment protection.

F. RFI: Radio-frequency interference.

G. RMS: Root mean square.

H. SPDT: Single pole, double throw.

## 1.3 PERFORMANCE REQUIREMENTS

A. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for all branches of normal and emergency power. Refer to Division 26 Section "Overcurrent Protective Device Coordination Study" for additional requirements.

1.4 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

B. Simultaneous Action Submittals: Panelboard Product Data submittal shall be made in conjunction with action submittals required under Division 26 Section "Overcurrent Protective Device Coordination Study." The release of electrical equipment submittals (panelboards, engine generators, switchgear, etc.) is dependent on the receipt of a complete and accurate overcurrent protective device coordination study. The Architect and Engineer require a full submittal review period as delineated in Division 01 Section "Submittal Procedures" to adequately review the OCPD study against the submitted electrical components prior to release of submittals for equipment procurement. The submittal schedule required by Division 01 requirements shall provide for this review time in the action submittal process. Delay claims arising due to Contractor's failure to coordinate simultaneous action submittals will not be considered by the Owner.

C. Product Data: For each type of panelboard, overcurrent protection device, accessory, and related component, include the following:

1. Manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
2. Rated capacities, features, operating characteristics, furnished specialties, factory settings, accessories and time-current characteristic curves for individual relays and overcurrent protective devices.

   a. Time-current curves for each type of overcurrent protection device. Include hardcopy of characteristic curve and TCC Number for use with Power Tools by SKM Systems Analysis, Inc. Indicate available setting points and selectable ranges for each type of adjustable overcurrent protection device.

D. Shop Drawings: For each panelboard and related equipment, include the following:

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show method of field assembly and location and size of each field connection. Include the following:

   a. Tabulation of installed devices with features and ratings.
   b. Enclosure types and details.
   c. Outline and general arrangement drawing showing dimensions, shipping sections, and weights of each assembled section.
   d. Bus configuration with size and number of conductors in each bus run, including phase, neutral, and ground conductors of main and branch buses.
   e. One-line diagram.
   f. Bus current and voltage ratings.
   g. Short-time and short-circuit current rating of equipment assembly.
   h. Feeder entry locations and lug configuration.
   i. Elevation drawing showing locations for anchor bolts.
   j. Nameplate legends.

2. Wiring Diagrams: For each type of panelboard and related equipment, include the following:

   a. Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit Coordination Drawings in accordance with Division 26 Section "Common Work Results for Electrical" for each location where panelboards are included in the Work.

B. Panelboard Directories: For installation in panelboards.

C. Field quality-control Test Method and Procedure: List of procedures to be used during functional and operations sequence testing. Method of Procedure should include but not be limited to the following:

1. Tabulation of Testing Equipment and PPE required for tests.
2. Schedule of Shutdowns required.
3. Manufacturer's Recommended Pre-Start Checklists for the following:

   a. Overcurrent Protection Devices

4. Step-by-Step Testing Operations and Criteria for tests listed in Part 3 Paragraph "Field quality-control".

D. Field quality-control test reports including the following:

1. Test results that comply with requirements.
2. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electrical equipment, accessories and components to be included in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's routine maintenance requirements for panelboard and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current curves, including selectable ranges for each type of relay and overcurrent protective device. Include directory listing each adjustable breaker included in the Work and their final set points.
4. Manufacturer's sample system checklists and log sheets.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Six spares for each type of panelboard cabinet lock.
2. Touchup Paint: Three 0.5 pintcontainers of paint matching enclosure finish.
3. Indicating Lights: one for every ten of each type and rating installed. Furnish at least one of each type.
4. Spare Fuses for the following:

a. Potential Transformer Fuses: One for every ten of each type and rating installed. Furnish at least one of each type.
b. Control-Power Fuses: One for every ten of each type and rating installed. Furnish at least one of each type.
c. Fuses for Fusible Power-Circuit Devices: One for every ten of each type and rating installed. Furnish at least three of each type.

5. Molded-Case Circuit Breakers rated 100 amperes and less: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: For independent agency as defined in Division 26 Section "Common Work Results for Electrical".

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer, unless otherwise indicated.

1. Breaker Manufacturer: Manufacturer for breakers shall be the same as the manufacturer of other breakers proposed for other portions of the Work.
2. Breaker Manufacturer for installation into existing panelboard: Manufacturer for breakers shall match the manufacturer of the existing equipment. For discontinued equipment, breaker shall be compatible and listed for installation within existing equipment.

C. Product Options: Drawings indicate spatial allocation for panelboards, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum spatial allocation. Refer to Division 01 Section "Product Requirements."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with IEEE C2.

F. Comply with NFPA 70.

G. Comply with NEMA PB 1 "Panelboards".

1.9 DELIVERY, STORAGE, AND HANDLING

A. Prepare equipment for shipment.

1. Provide suitable crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
2. Weatherproof equipment for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.

B. Installation Pathway: Coordinate delivery of equipment to allow movement into designated space.

1. Deliver in shipping splits in sizes that can be moved past obstructions in delivery path.
2. Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving equipment into place.

C. Store equipment indoors in clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.

D. Handle equipment components according to manufacturer's written instructions. Use factory-installed lifting provisions.

E. Handle panelboards according to NEMA PB 1.1 and NECA 407.

1.10 PROJECT CONDITIONS

A. Interruption of Existing Electric Service: Comply with requirements defined in Division 26 Section "Common Work Results for Electrical".

B.

C. Environmental Limitations: Rate equipment for continuous operation at indicated ampere ratings for the following conditions:

1. Ambient Temperature for Circuit Breakers: Not less than **23 deg F** and not exceeding 104 deg F.

2. Ambient Temperature for Fused Switches: Not less than minus 22 deg F and not exceeding 104 deg F.

3. Altitude: Not exceeding 6600 feet (2000 m).

a.

1.11 COORDINATION

A. Coordinate layout and installation of panelboard and components with other construction that penetrates floors, ceilings or walls or are supported by them, including but not limited to conduit, piping, other electrical equipment, light fixtures, HVAC equipment, fire-suppression-system components and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cutler-Hammer, Inc.; Eaton Corporation.
2. General Electric Co.; Consumer and Industrial Div.
3. Siemens Energy & Automation, Inc.
4. Square D; Schneider Electric.

2.2 RATINGS

A. Suitable for application in 3-phase, 60-Hz, solidly grounded-neutral system, unless otherwise indicated.

B. Nominal System Voltage: As indicated on the Drawings.

C. Main-Bus: Amperage as indicated on the Drawings. Provide continuous rating across entire length of main-bus.

D. Short-Time and Short-Circuit Current: Match rating of highest-rated overcurrent protective device in panelboard assembly.

1. Available Short-Circuit Current: As indicated on the Drawings.

2.3 MANUFACTURED UNIT FABRICATION

A. Mounting height of breakers shall be in accordance with NFPA 70 requirements. Fabrication of equipment shall take housekeeping pad dimension into account in determining height of top breaker in all sections. Refer to Division 26 Section "Hangers and Supports for Electrical Systems" for housekeeping pad specifications.

B. Enclosures: Flush- and surface-mounted cabinets, as indicated. NEMA PB 1.

1. Rated for environmental conditions at installed location.

a. Indoor Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

e. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2. Front Cover: Provide the following, unless otherwise indicated:

a.
b. Hinged Front Cover: Door-in-Door construction with entire front trim hinged to box and with standard door within hinged trim cover to access device handles.

3. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard ANSI Gray enamel over corrosion-resistant treatment or rust-inhibiting primer coat.

C. Buses and Connections: Three phase, four wire, unless otherwise indicated.

1. Phase- and Neutral-Bus Material: [Hard-drawn copper of 98 percent conductivity, silver-plated, with copper feeder circuit-breaker line connections.

a. Lugs: Mechanical style, one or two hole style to suit conditions, suitable for quantity and size of conductor. UL 486 B listed, dual rated and marked for use with copper- or aluminum conductors to suit project conditions.

2. Ground Bus: Hard-drawn copper of 98 percent conductivity, Adequate for feeder and branch-circuit equipment ground conductors; bonded to box. Equipped with mechanical connectors for feeder and branch-circuit ground conductors.
3. Neutral Buses: 100 percent of the ampacity of phase buses, unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables.

4. Bus Size: Comply with UL 489, including allowance for spare circuit breakers and spaces for future circuit breakers. Include bus to extend the full length of vertical sections.
5. Support and Brace Buses for indicated short-circuit currents.
6. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of panelboard section.
7. Conductor Connectors: Suitable for use with conductor material; dual rated for use with copper- or aluminum conductors; marked AL7CU for 75 degrees C rated circuits.

8. Feed-Through Lugs where indicated on Drawings: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
9. Isolated Equipment Ground Bus, where indicated on Drawings: Adequate for branch-circuit equipment ground conductors; insulated from box.
10. Extra-Capacity Neutral Bus, where indicated on Drawings: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
11. Extra-Capacity Neutral Lugs: Where Extra-Capacity Neutral Bus is indicated on Drawings, provided lugs rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

D. Future Device Provision: Equip compartments with unused space with mounting brackets, bus connections, and necessary appurtenances required for future installation of devices. Provide bussing for full length of enclosure section.

E. DISTRIBUTION PANELBOARDS

1. Door Hardware: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.

2. Main Overcurrent Protection Device Type: Provide overcurrent device as follows, unless otherwise indicated: Circuit breaker

   a. Main OCPD rated less than 250 Amps: Electronic Trip-Unit Circuit Breakers.
   b. Main OCPD rated 250 Amps and greater: Electronic Trip-Unit Circuit Breakers.

3. Feeder Overcurrent Protection Device Type: Provide overcurrent device as follows, unless otherwise indicated: Circuit breaker.

   a. Feeder OCPD rated less than 250 Amps: Adjustable Instantaneous-Trip; Bolt-on circuit breakers.
   b. Feeder OCPD rated 250 Amps and greater: Electronic Trip-Unit**;** Bolt-on circuit breakers or plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

4. Branch Overcurrent Protection Device Type: Provide overcurrent device as follows, unless otherwise indicated: Circuit breaker.

   a. Branch OCPD: Thermal-Magnetic; Bolt-on circuit breakers replaceable without disturbing adjacent units.

F. LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

1. Door Hardware: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2. Main Overcurrent Protection Device Type: Provide overcurrent device as follows, unless otherwise indicated: Circuit breaker.

   a. Main OCPD rated less than 250 Amps: Adjustable Instantaneous-Trip Circuit Breakers.
   b. Main OCPD rated 250 Amps and greater: Adjustable Instantaneous-Trip Circuit Breakers.

3. Branch Overcurrent Protection Device Type: Provide overcurrent device as follows, unless otherwise indicated: Circuit breaker.

   a. Branch OCPD: Thermal-Magnetic; Bolt-on circuit breakers replaceable without disturbing adjacent units.
   b.

## 2.4 OVERCURRENT PROTECTIVE DEVICES

A. Series–rated devices are not permitted.

B. Molded-Case Circuit Breaker Requirements: UL 489, NEMA AB 3, with interrupting capacity rating to meet available fault current.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. **Electronic trip-unit circuit breakers:** RMS sensing, field-replaceable rating plug, and the following field-adjustable settings:

   a. Long- and short-time pickup levels.
   b. Long- and short-time time adjustments.
   c. Instantaneous trip.
   d. Ground-fault pickup level, time delay, and $I^2t$ response, where indicated.
   e. Ground-fault indication alarm, where indicated.

4. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity. Provide as indicated and as required by NFPA 70 for personnel protection.
5. GFEP Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity. Provide as indicated and as required by NFPA 70 for equipment protection.
6. AFCI Circuit Breakers: Single- and two-pole configurations. Provide as indicated and as required by NFPA 70 for personnel protection.

C. Molded-Case Circuit-Breaker Features: Standard frame sizes, trip ratings, and number of poles. Provide the following features for all included in the Work:

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material; UL 486 B listed, dual rated and marked for use with copper- or aluminum load-side conductors.

2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Lock-Out Tag Provisions: For installing at least three Lock-Out tags on each circuit breaker to secure the breaker and prevent movement mechanism.

4. Communication Capability: Communication module with functions and features compatible with power monitoring and control system specified in Instrumentation paragraph Part 2 – Products of this Section

D. Circuit-Breaker Accessories: Standard frame sizes, trip ratings, and number of poles. Provide the following accessories where indicated:

1. Ground-Fault Protection: Provide integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2. Shunt Trip: Set to trip at 55 percent of rated voltage, where indicated.
3. Communication Capability: Communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
4. Key Interlock Kit: where indicated, provide to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

5.
6. Auxiliary Switch: where indicated, provide two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
7. Remote trip indication and control.

E.

## 2.5 INSTRUMENTATION

A. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:

1. Potential Transformers: Secondary voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
2. Current Transformers: Ratios with accuracy class and burden suitable for connected relays, meters, and instruments.

B.

C. Power Monitor: Microprocessor-based Multifunction Digital-Metering Monitor unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

a. Phase Currents, Each Phase: Plus or minus 1 percent.
b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
d. Megawatts: Plus or minus 2 percent.
e. Megavars: Plus or minus 2 percent.
f. Power Factor: Plus or minus 2 percent.
g. Frequency: Plus or minus 0.5 percent.

h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
j. Contact devices to operate remote impulse-totalizing demand meter.

2. Mounting: Display and control unit flush or semi-flush mounted in panel cover trim.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Furnish portable test set to test functions of solid-state trip devices without removal from panelboard.

B. Storage for Manual: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces where equipment will be installed for compliance with installation tolerances, required clearances, and other conditions affecting performance.

B. Examine roughing-in of conduits to verify the following:

1. Wiring entries comply with layout requirements.
2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders will have to cross section barriers to reach load or line lugs.

C. Verify that ground connections are in place and that requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met.

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

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with NECA 407, "Recommended Practice for the Installing and Maintaining Panelboards" as published by the National Electrical Contractors Association.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards and components once unit is secured in place.

D. Comply with mounting and support requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Mount top of trim 74 inches above finished floor, unless otherwise indicated.

F. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

G. Install overcurrent protective devices, controllers, and instrumentation.

H. Install filler plates in unused spaces.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

J. For Recessed Panels: Stub four 1-inchempty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.

K. Close unused conduit opening or other unused holes in sides of box with proper mating blank-off plates.

L. Do not use gutters of panelboards as raceways for routing feeder conductors from bottom entrance to top-feed lugs or vice versa; an external gutter or conduit shall be used for this purpose.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components and provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

B. Equipment Identification Nameplates: Label each panelboard with engraved Equipment Identification Label as specified in Division 26 Section "Identification for Electrical Systems."

C. Distribution Panelboard Feeder OCPD Labels: Label each OCPD with nameplate that indicates the device it feeds using engraved Equipment Identification Label as specified in Division 26 Section "Identification for Electrical Systems."

D. Panelboard Directory: Create a directory to indicate name/descriptions of installed circuit loads, including final room numbers**.** Obtain final room numbers from Owner. Obtain approval before installing within clear plastic pocket inside panelboard cover. Use a computer to create directory; handwritten directories are not acceptable.

E. Diagram and Instructions:

1. Frame and mount the following items in clear acrylic plastic holder on the front of panelboard.

a. Operating Instructions: Printed basic instructions for panelboard, including control and emergency procedures where applicable.

3.4 CONNECTIONS

A. Tighten bus joints, electrical connectors, and terminals according to manufacturer's published torque-tightening values.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

D.

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.
3. Assist in field testing of equipment including pre-testing and adjusting of equipment and components.

B. Perform the following field tests and inspections and prepare test reports:

1. Test mounting and anchorage devices according to requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
2. Inspect panelboard installation, including wiring, components, connections, and equipment. Test and adjust components and equipment.
3. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 26 Sections.

C. Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 26 Section "Common Work Results for Electrical" to perform the following field tests and inspections and prepare certified test reports:

1. After installing panelboard but before equipment is energized, verify that grounding system at panelboard tests to specified value or better.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:

   a. Section 7.1 for Switchgear & Switchboard Assemblies
   b. Section 7.3 for Cables
   c. Section 7.5 for Switches
   d. Section 7.6 for Circuit Breakers
   e. Section 7.11 for Metering and Instrumentation Devices
   f. Section 7.13 for Grounding Systems
   g. Section 7.14 for Ground-Fault Protection Systems; where applicable.

3. Infrared Scanning: Perform Thermographic Survey in accordance with NETA ATS, Section 9.0.

   a. Initial Infrared Scanning: Within 60 Days after Substantial Completion, perform an infrared scan of each panelboard. Open or remove doors and covers so connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
   c. Instruments, Equipment:

      1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Complete installation and startup checks according to manufacturer's written instructions.

D. Correct Deficiencies, Retest and Report:

1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace conductors, units, and devices as required to bring system into compliance.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Prepare a report, certified by testing agency, that identifies switchboards, units, conductors and devices checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.6 ADJUSTING

A. Set field-adjustable overcurrent protection device trip characteristics according to settings provided by Engineer-of-Record.

1.
2. Settings will be provided by Engineer-of-Record after the submittal process and review of report required by Division 26 Section "Overcurrent Protective Device Coordination Study." are completed.

3.7 CLEANING

A. Clean components according to manufacturer's written instructions.

B. Prior to installation of front trim and cover plates inspect interior surfaces and perform the following:

1. Remove paint splatters and other spots.
2. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

C. On completion of front trim and cover installation, inspect exterior surfaces and perform the following:

1. Remove paint splatters and other spots.
2. Remove all temporary markings and labels.
3. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
4. Repair exposed surfaces to match original finish.

3.8 PROTECTION

A. Temporary Heating: Maintain a clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Apply temporary heating as required.

B. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's management and maintenance personnel to adjust, operate, and maintain panelboards, overcurrent protective devices, instrumentation, and accessories. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 262416

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Hospital-grade receptacles.
3. Isolated-ground receptacles.
4. Tamper-resistant receptacles.
5. Weather-resistant receptacles.
6. USB receptacles.
7. Twist-locking receptacles.
8. Pendant cord-connector devices.
9. Cord and plug sets.
10. Switches and wall-box dimmers.
11. Digital time switches.
12. EPO switches.
13. Floor service outlets, poke-through assemblies, multioutlet assemblies, and service poles.

B. Related Sections include the following:

1. Division 26 Section "Lighting Control Devices" for switchbox-mounted occupancy sensors.

## 1.2 DEFINITIONS

A. EPO: Emergency power off.

B. EMI: Electromagnetic interference.

C. GFCI: Ground-fault circuit interrupter.

D. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

E. RFI: Radio-frequency interference.

F. SPD: Surge Protective Device.

G. UTP: Unshielded twisted pair.

## 1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

2. Cord and Plug Sets: Match equipment requirements.

1.4 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

B. Product Data: For each type of product indicated under PART 2 – PRODUCTS.

C. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

D. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:

1. Manufacturer's routine maintenance requirements for wiring devices and all installed components.
2. Manufacturers' packing label warnings and instruction manuals.

1.7 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Service/Power Poles: One for every 10, but no fewer than one.
2. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.
3. Keys for Locking Switches and Covers: One for every 10 of each type installed, but no fewer than two of each type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: For independent agency as defined in Division 26 Section "Common Work Results for Electrical".

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

C. Comply with NFPA 99

D. Comply with NFPA 70

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles. Part numbers listed under products paragraphs in Part 2 articles of this section are included to list the manufacturers' product series and they do not designate the color of the device. Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
2. Leviton Mfg. Company Inc. (Leviton).
3. Pass & Seymour/Legrand; (Pass & Seymour).

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT BLADE RECEPTACLES

A. Hospital-Grade, Convenience Receptacles, Standard Style, 125 V, 20 A:

1. Requirements:

a. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, UL 498 Supplement SD, and Federal Specification (FS) W-C-596.
b. Description: Hospital Grade receptacles constructed of high-impact resistant thermoplastic. Wide-body design; back and side-wired; Triple wipe, T-slot, one-piece copper alloy contact design; One-piece nickel-plated brass wrap-around type grounding strap, interlocked into the body in at least 4 points; green ground screw and automatic grounding system attached to the strap; Green dot on the face to signify Hospital Grade.

2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL8310 (simplex), HBL8300 (duplex).
b. Leviton; 8310 (simplex), 8300 (duplex).
c. Pass & Seymour; 8301 (simplex), 8300 (duplex).

a. Modular option:

1) Hubbell; SNAP8300x & SNAP2RNA (duplex).
2) Leviton; M8300 & MSTWL-A (duplex).
3) Pass & Seymour; PT8300H & PTRA6STR (duplex).

B. Hospital-Grade, Tamper-Resistant Convenience Receptacles, Standard Style, 125 V, 20 A:

1. Requirements:

a. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD and Federal Specification (FS) W-C-596. Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
b. Description: Hospital Grade straight blade receptacle constructed of high-impact resistant thermoplastic. Wide-body design; back and side-wired; Triple wipe, T-slot, one-piece copper alloy contact design; One-piece nickel-platted brass wrap-around type grounding strap, interlocked into the body in at least 4 points; green ground screw and automatic grounding system attached to the strap; Green dot on the face to signify Hospital Grade.

2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL8300SG.
b. Leviton; 8300-SG.
c. Pass & Seymour; TR63-H

1)

2.4 GFCI RECEPTACLES

A. Hospital-Grade, GFCI Convenience Receptacles, 125 V, 20 A:

1. Requirements:

a. Comply with NEMA WD 1, NEMA WD 6, UL 498 Supplement SD, UL 943, Class A, and Federal Specification (FS) W-C-596.
b. Feed-through type, nominal sensitivity to earth leakage of 4-6 milliamperes; Meeting 2006 CSA/UL requirements for End of Life Provision and Reverse Line-Load Miswire.

1) Device shall either render itself incapable of delivering power or indicate by visual or audible means that the device can no longer provide ground fault protection.
2) Device shall not allow current to pass through device when miswired.

c. Description: Hospital Grade straight blade receptacle constructed of high-impact resistant thermoplastic. Wide-body design; back and side-wired; Triple wipe, T-slot, one-piece copper alloy contact design; One-piece nickel-platted brass grounding strap, interlocked into the body in at least 4 points; green ground screw and automatic grounding system attached to the strap; Green dot on the face to signify Hospital Grade. LED indicator on face.

2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; GFR8300HxLA.
b. Leviton; N7899-HG.
c. Pass & Seymour; 2095-HG.

B. Hospital-Grade, Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

1. Requirements:

a. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD, UL 943, Class A, and Federal Specification (FS) W-C-596. Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
b. Feed-through type, nominal sensitivity to earth leakage of 4-6 milliamperes; Meeting 2006 CSA/UL requirements for End of Life Provision and Reverse Line-Load Miswire.

1) Device shall either render itself incapable of delivering power or indicate by visual or audible means that the device can no longer provide ground fault protection.
2) Device shall not allow current to pass through device when miswired.

c. Description: Hospital Grade straight blade receptacle constructed of high-impact resistant thermoplastic. Wide-body design; back and side-wired; Triple wipe, T-slot, one-piece copper alloy contact design; One-piece nickel-platted brass grounding strap, interlocked into the body in at least 4 points; green ground screw and automatic grounding system attached to the strap; Green dot on the face to signify Hospital Grade.

2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; GFR8033HTR.
b. Leviton; X7899-HG
c. Pass & Seymour; 2095-HGTR

## 2.5 USB RECEPTACLES

A. Hospital-Grade, USB, Tamper-Resistant Convenience Receptacles, Decorative Style 125 V, 20 A:

1. Requirements:

a. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, UL 498 AND 1310.
b. Description: Hospital Grade receptacle constructed of high-impact resistant thermoplastic with two USB 2.0 charging ports. Wide-body design; back and side-wired; Triple wipe, T-slot, one-piece copper alloy contact design; One-piece steel grounding strap, interlocked into the body in at least 4 points; green ground screw and automatic grounding system attached to the strap; Green dot on the face to signify Hospital Grade.

2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; USB8300.
b. Leviton; T5832-HG.

## 2.6 SPECIAL CONFIGURATION & TWIST-LOCKING RECEPTACLES

A. General: NEMA and Non-NEMA configurations as indicated on Drawings.

1. Requirements: Comply with NEMA WD 1, NEMA WD 6; and UL 498.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hubbell.
b. Leviton.
c. Pass & Seymour.

2.7 CORD AND PLUG SETS

A. General: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Requirements:

a. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
b. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hubbell.
b. Leviton.
c. Pass & Seymour.

2.8 SWITCHES

A. General Description: All products listed shall meet the following requirements:

1. Comply with NEMA WD 1, UL 20; Rated UL-94, V2 or better. Manufacturer shall test all switches for proper operation prior to shipment, sample testing is not acceptable.
2. Description: Constructed of high-impact arc-resistant thermoplastic; back and side-wired; heavy-gauge copper alloy one-piece arm and silver-cadmium oxide contacts with quiet-action mechanism; heavy-gauge zinc-plated steel-mounting strap with automatic grounding feature. Compatible with fluorescent, tungsten and resistive loads; with a motor load capacity of at least 80% of switch's current rating. Terminal screws shall be brass double-combination: Philips-head, slotted. Mounting screws shall be triple combination: Philips-head, slotted, Robertson.

B. Toggle Switches, 120/277 V, 20 A:

1. Requirements: Comply with Federal Specification (FS) W-S-896; Industrial Specification Grade toggle switch.
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL1221 (single pole), HBL1222 (two pole), HBL1223 (three way), HBL1224 (four way).
b. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
c. Pass & Seymour; PS20AC1 (single pole), PS20AC2 (two pole), PS20AC3 (three way), PS20AC4 (four way).

d. Modular option:

1) Hubbell; SNAP1221 & SNAPSP1NA (single pole), SNAP1223 & SNAPSP2NA (three-way).
2) Leviton; M1221 and MSPSW (single pole).
3) Pass & Seymour; PT20AC1 & PTRA6STR (single pole), PT20AC3 & PTRA6STR (three-way).

C. Illuminated Light Switches, 120/277 V, 20 A:

1. Requirements: Industrial Specification Grade toggle switch; Single pole, with LED or NEON-lighted handle, illuminated when switch is "OFF."
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL1221IL (single pole); HBL1223IL (3-way) for 120/277V.
b. Leviton; 1221-LHC (single pole), 1223-LHC (3-way) for 120 V; 1221-7LC (single pole) 1223-7LC (3-way) for 277 V.
c. Pass & Seymour; PS20AC1-CSL (single pole); PS20AC3-CSL (3-way) for 120/277V.

d. Modular option:

1) Hubbell; SNAP1221IL & SNAPSP1NA (single pole), SNAP1223IL & SNAPSP2NA (three-way).
2) Leviton; M1221-LHC (single pole), M1223-LHC (3-way) for 120 V.
3) Pass & Seymour; PT20AC1-CSL & PTS6STR3 (single pole), PT20AC3CSL & PTS6STR4 (three-way) for 120 V, PT20AC1-CSL & PTS6STR3277 (single pole), PT20AC3CSL & PTS6STR4277 (three-way) for 277 V.

D. Key-Operated / Security Switches, 120/277 V, 20 A:

1. Requirements: Single pole, with factory-supplied key in lieu of switch handle. Corbin-style or Barrel lock and key, single-hump key not acceptable.
2. Description: Single pole, with factory-supplied key in lieu of switch handle.
3. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL1221RKL.
b. Leviton; 1221-2KL.
c. Pass & Seymour; PS20AC1-KL.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; HBL1557.
b. Leviton; 1257.
c. Pass & Seymour; 1251.

F. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 24 V.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Leviton; 1081.
b. Pass & Seymour; 1081.

G. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A;

1. Requirements: with factory-supplied key in lieu of switch handle. Corbin-style or Barrel lock and key, single-hump key not acceptable.
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Hubbell; HBL1557L.
    b. Leviton; 1257L.
    c. Pass & Seymour; 1251L.

2.9 WALL-BOX DIMMERS

A. General Description: All products listed shall meet the following requirements:

1. Dimmer Switches: Modular, full-wave, solid-state unit with integral, quiet on-off switch complying with UL 20; audible frequency and EMI/RFI suppression filters.
2. Comply with ANSI/IEEE standard C62.41-1997 for surge withstand.

3. Control: Continuously adjustable toggle switch; with single-pole or three-way switching. Comply with UL 1472.
4. Memory: Power-failure memory to maintain previously set lighting level upon return of power after outage without human intervention.

B. Fluorescent Lamp Dimmer Switches, 120/277 V:

1. Requirements: Control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module. Modular; compatible with dimmer ballasts as specified under Division 26 Section "Interior Lighting"; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness. Dimmers shall require no derating when ganged with other devices; provide narrow-fin and wide-fin designs as required.
2. Products: Subject to compliance with requirements, provide products from one of the following manufacturers:

    a. Leviton.
    b. Lutron.

2.10 FAN SPEED CONTROLS

A. Modular, 120-V:

1. Requirements: Full-wave, solid-state units with integral, quiet on-off switches complying with UL20, and audible frequency and EMI/RFI filters. Comply with UL 1917.

    a. Continuously adjustable slider, 5 A.
    b. Three-speed adjustable slider, 1.5 A.

2. Products: Subject to compliance with requirements, provide products from one of the following manufacturers:

    a. Hubbell.
    b. Leviton.
    c. Lutron.
    d. Novitas.
    e. Pass & Seymour.

2.11 DIGITAL TIME WALL SWITCH

A. Requirements: Adjustable time delay up to 2 hours, LCD digital display, Audible or 'Blink' Warning.

B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Hubbell Building Automation; TD200.
2. Hubbell; DT1277.
3. Leviton; LTBxx.
4. Watt Stopper; TS-400.

2.12 EPO SWITCHES

A. General Description: All products listed shall meet the following requirements:

1. Operators shall be heavy duty type and comply with UL Type 13/NEMA Type 13 and UL Type 6/NEMA Type 6.
2. Contact blocks shall be rated 10 amperes continuous.

B. Available Products: Subject to compliance with requirements, provide the following as indicated on the Drawings:

1. Push button type: Flush mounted, two position, momentary push button, red insert, with one normally open and one normally closed (1NO - 1NC) contact. Provide with a hinged, lockable protective cover guard.

2.13 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Requirements:

a. Plate-Securing Screws:

1) Metal with head color to match plate finish.
2) Tamper-resistant metal screws with head color to match plate finish for Secure and Disturbed Patient Holding and similar rooms.

b. Material for Finished Areas: Smooth, high-impact thermoplastic (nylon).

c. Material for Utility Areas: Smooth, high-impact thermoplastic (nylon).

d. Material for Unfinished Areas: Smooth, high-impact thermoplastic (nylon).
e. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

f. Material for Multi-device wall plates over 4-gang: 0.05-inch-thick anodized aluminum.

2. Products: Subject to compliance with requirements, provide plate from same manufacturer as device.

B. Wet-Location, Weatherproof Cover Plates:

1. Requirements: NEMA 250, complying with type 3R weather-resistant, extra-duty, while-in-use cover and base with lockable cover; non-removable gasket between the mounting plate/base and cover; stainless steel hinges and mounting hardware.
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cover and Base Material: UV resistant polycarbonate.

1) Leviton;

a) Vertical Mount: Clear, 5981-UCL.

2) Pass & Seymour; Horizontal or Vertical Mount: Frosted, WIUC10FRED.
3) TayMac Corporation; a Division of Hubbell Incorporated;

a) Horizontal or Vertical Mount: Clear, MM420C.

2.14 FLOOR SERVICE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell.
2. Thomas & Betts Corporation.
3. Wiremold Company (The).

B. Requirements:

1. Type: Modular, flush-type, dual-service units suitable for wiring method used.
2. Compartments: Barrier separates power from voice and data communication cabling.
3. Service Plate: Rectangular, with satin finish, powder painted or electro-plated finish.
4. Power Receptacle: NEMA WD 6 configuration 5-20R,, meeting the requirements for receptacles listed in this section above, unless otherwise indicated.
5. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable,.

2.15 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Wiremold Company (The).

B. Description:

1. Two-piece surface metal raceway, with factory-wired multioutlet harness.
2. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: Aluminum.

D. Multioutlet Harness:

1. Receptacles: Meeting the requirements for receptacles listed in this section above, unless otherwise indicated.
2. Receptacle Spacing: As indicated on Drawings.
3. Wiring: No. 12 AWG solid, Type THHN copper, single circuit.

E. Finish: As indicated on Drawings

F. Power Receptacle: NEMA WD 6 configuration 5-20R,, meeting the requirements for receptacles listed in this section above, unless otherwise indicated.

G. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable.

2.16 FINISHES

A. Color: Wiring device catalog numbers in Section Text above do not designate device color. The wiring devices and associated wall plates shall conform to the colors listed in Table 1 below or as otherwise required by NFPA 70. Final color selections for all devices and wall plates shall be submitted to and approved by the Architect.

1. * Indicates: Provide Orange Triangle on device to Indicate Isolated Ground Receptacle
2. ** Indicates: Engrave (Metal) or Hot Stamp (Thermoplastic) as indicated in "Identification" paragraphs of PART 3 - Execution section.

Table 1

| Connected to Normal Power in Finish Areas | Device | Wall Plate | Lettering** |
|---|---|---|---|
| Standard NEMA 5-20R Receptacles | White | White | Black |
| Isolated Ground NEMA 5-20R Receptacles | White* | White | Black |
| Tamper Resistant NEMA 5-20R Receptacles | White | White | Black |
| GFCI NEMA 5-20R Receptacles | White | White | Black |
| Auto Plug Load Controlled NEMA 5-20R Recep-tacles | White | White | Black |
| USB NEMA 5-20R Receptacles | White | White | Black |
| SPD NEMA 5-20R Receptacles | Blue | White | Black |
| IG-SPD NEMA 5-20R Receptacles | Blue* | White | Black |
| Switches & Wall Box Dimmers | White | White | Black |
| Switchbox-Mounted Occupancy Sensors | White | White | Black |
| **Connected to Normal Power in Utility Areas** | **Device** | **Wall Plate** | **Lettering**** |
| Standard NEMA 5-20R Receptacles | White | Metal | Black |
| GFCI NEMA 5-20R Receptacles | White | Metal | Black |
| Switches | White | Metal | Black |
| Switchbox-Mounted Occupancy Sensors | White | Metal | Black |

| Connected to Emerg. Pwr. in Finish Areas | Device | Wall Plate | Lettering** |
|---|---|---|---|
| Standard NEMA 5-20R Receptacles | Red | Red | White |
| Isolated Ground NEMA 5-20R Receptacles | Red* | Red | White |
| Tamper Resistant NEMA 5-20R Receptacles | Red | Red | White |
| GFCI NEMA 5-20R Receptacles | Red | Red | White |

| | | | |
|---|---|---|---|
| Auto Plug Load Controlled NEMA 5-20R Receptacles | Red | Red | White |
| USB NEMA 5-20R Receptacles | Red | Red | White |
| SPD NEMA 5-20R Receptacles | Blue | Red | White |
| IG-SPD NEMA 5-20R Receptacles | Blue* | Red | White |
| Switches & Wall Box Dimmers | Red | Red | White |
| Switchbox-Mounted Occupancy Sensors | White | Red | White |
| **Connected to Emerg. Pwr. in Utility Areas** | **Device** | **Wall Plate** | **Lettering**** |
| Standard NEMA 5-20R Receptacles | Red | Metal | Red |
| GFCI NEMA 5-20R Receptacles | Red | Metal | Red |
| Switches | Red | Metal | Red |
| Switchbox-Mounted Occupancy Sensors | White | Metal | Red |

| **Connected to UPS Power System** | **Device** | **Wall Plate** | **Lettering**** |
|---|---|---|---|
| Isolated Ground NEMA 5-20R Receptacles | Orange | White | Black |
| Under-floor Isolated Ground NEMA 5-20R Receptacles | Orange | Metal | Black |
| Switchbox-Mounted Occupancy Sensors | Orange | White | Black |

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following for all indoor applications, unless otherwise indicated:

1. Receptacle Grade: Hospital-Grade
2. Receptacle Style: Standard
3. Switch Style: Toggle

B. Receptacles in Patient Care Areas: Install Hospital Grade devices where device is located within a Patient Care Area as defined by NFPA 70 Article 517 or the Authorities Having Jurisdiction.

C. GFCI Receptacles: Install in locations as indicated but in no case less than those listed below:

1. Where device is located on the exterior of the building, provide with Wet-Location Weatherproof Cover Plate.
2. Where device is located within kitchen.
3. Where device is located within a garage.
4. Where device is located in an elevator pit.

5. Where device is located within 6 feet (2-m) of a lavatory or sink, except where located on patient headwall.

D. Tamper-Resistant Receptacles: Install in locations as indicated but in no case less than those listed below:

1. Public Lobbies.
2. Waiting Rooms.
3. Play Rooms and other similar rooms that children are expected to occupy.

4. Pediatric Patient Care Areas.
5. Secure and Disturbed Patient Holding and similar rooms.

## 3.2 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise indicated.

B. Mounting Heights:Comply with applicable codes and requirements of Authorities Having Jurisdiction. Mount devices as listed below or as otherwise indicated on Drawings, including but not limited to Architectural elevations. Coordinate all above counter receptacles with backsplash to avoid interferences. All dimensions are given to centerline of box above finished floor (AFF), unless otherwise indicated.

C. Comply with mounting and support requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."

D. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.
5. Install wiring devices with appropriate backbox and raceway according to room finish (i.e. flush mounted devices in recessed backboxes with concealed conduit in finished spaces; surface mounted boxes with exposed conduit in unfinished spaces. Refer to Architectural Documents for room finish types.

E. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

F. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until substantial completion.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
10. Mount Switches or Wall Box Dimmers within 6 inches of door frame, unless otherwise indicated.
11. Install Isolated-Ground devices so as not to bond the ground pole or isolated ground conductor (green/yellow) to the conduit system or equipment ground conductor (green).
12. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical.

G. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up and on horizontally mounted receptacles to the left (i.e. neutral blade at the top).

H. Device Plates and Covers:

1. Do not use oversized or extra-deep plates.
2. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
3. Install weather-proof-while-in-use covers over receptacles in wet, damp and exterior locations.
4. Group adjacent devices under single, multigang wall plates.

I. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

J. Floor Service Outlets, Service Poles and Poke-Thru Device

1. Adjust locations of floor service outlets, service poles, and Poke-Thru devices to suit arrangement of partitions and furnishings. Coordinate revised location with Structural Engineer.
2. Install Poke-Thru devices within their listing. Install devices so there is no more than 1 device per 64-square-feet (5.95-Square-meters) of floor area and so there is no less than 2-feet (.61-m) separation between adjacent devices.

3.3 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1.
2. Receptacles: Identify panelboard and circuit number from which served on all receptacles. Use Engraved machine printing for Metal and Hot Stamped for Thermoplastic wall plates. All lettering shall be filled on face of plate, lettering color as indicated in the table in Part 2 above.
3. Switches: Identify panelboard and circuit number from which served on All Switches. Use Engraved machine printing for Metal and Hot Stamped for Thermoplastic wall plates. All lettering shall be filled on face of plate, lettering color as indicated in the table in Part 2 above.

3.4 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. For EPO switches, provide 120V power where control power is not provided from equipment.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 26 Section "Common Work Results for Electrical" to perform the following field tests and inspections and prepare certified test reports:

1. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems.
2. Tests for Convenience Receptacles:

   a. Line Voltage: Acceptable range is 105 to 132 V.
   b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
   c. Ground Impedance: Values of up to 2 ohms are acceptable.
   d. Polarity: test for correct neutral conductor to neutral terminal connection.
   e. Using the test plug, verify that the device and its outlet box are securely mounted.
   f. GFCI Receptacles: Test for tripping values specified in UL 1436 and UL 943.

3. Tests for patient-care areas in Healthcare Facilities: In addition to the test listed above, perform additional field tests and inspections for receptacles in patient care areas. Perform the following tests:

   a. Test straight blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz..
   b. Test and record the resistance between the ground point of each receptacle and the reference point according to NFPA 99. Resistance level shall be less than 0.1 Ohm.

4. Prepare certified test reports in compliance with NFPA 99 and submit reports in conjunction with field quality control reports required in Division 26 Section "Grounding and Bonding for Electrical Systems". Utilize the Patient Care Area Electrical Testing Form in the Appendix of Division 26 Section "Grounding and Bonding for Electrical Systems" for each patient care area.

5. Test Instruments:

   a. Use instruments that comply with UL 1436.
   b. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Correct Deficiencies and Report:

1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace devices as required to bring system into compliance.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Prepare a report, certified by testing agency, that identifies enclosure, units, conductors and devices checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

C. Wiring device will be considered defective if it does not pass tests and inspections.

3.6 CLEANING

A. Clean components according to manufacturer's written instructions.

B. On completion of device box installation but before any wiring devices are installed, inspect interior of boxes and perform the following:

1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

C. On completion of wall plate installation, inspect exterior surfaces and perform the following:

1. Remove paint splatters and other spots.
2. Remove all temporary markings and labels.
3. Replace cracked or damaged wall plates.
4. Wipe down all wall plates with approve cleaning agent to remove fingerprints and dust.

END OF SECTION 262726

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Cartridge fuses rated 600 V and less for use in the following:

   a. Control circuits.
   b. Enclosed controllers.
   c. Enclosed switches.

## 1.2 PERFORMANCE REQUIREMENTS

A. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for all branches of emergency power. Refer to Division 26 Section "Overcurrent Protective Device Coordination Study" for additional requirements.

## 1.3 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

B. Simultaneous Action Submittals: Fuse Product Data submittal shall be made in conjunction with action submittals required under Division 26 Section "Overcurrent Protective Device Coordination Study." The release of electrical equipment submittals (panelboards, engine generators, switchgear, etc.) is dependent on the receipt of a complete and accurate overcurrent protective device coordination study. The Architect and Engineer require a full submittal review period as delineated in Division 01 Section "Submittal Procedures" to adequately review the OCPD study against the submitted electrical components prior to release of submittals for equipment procurement. The submittal schedule required by Division 01 requirements shall provide for this review time in the action submittal process. Delay claims arising due to Contractor's failure to coordinate simultaneous action submittals will not be considered by the Owner.

C. Product Data: Include the following:

1. For each fuse type indicated, provide dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. For fuse cabinet, provide construction details, material descriptions, dimensions of individual components and profiles, and finishes.
3. Let-through current curves for fuses with current-limiting characteristics.
4. Time-current curves, coordination charts and tables, and related data. Include hardcopy of characteristic curve and TCC Number for use with Power Tools by SKM Systems Analysis, Inc.
5. Tabulated schedule which indicates type, characteristics, and ratings of individual fuses and lists the devices and equipment in which they will be applied.

6. Fuse size for elevator feeders and elevator disconnect switches.

D. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Let-through current curves for fuses with current-limiting characteristics.
2. Time-current curves, coordination charts and tables, and related data.
3. Ambient temperature adjustment information.

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Quantity equal to one for every ten of each type and rating installed. Furnish at least three of each type.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from a single source from a single manufacturer.

B. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels. Provide fuses to match utilization equipment requirements.

1.7 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.8 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size. Provide fuses to match utilization equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussman; a division of Cooper Industries.
2. Edison; a brand of Cooper Bussman; a division of Cooper Industries.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.
5. Mersen USA.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. Comply with NEMA FU 1.

D. Comply with NFPA 70.

2.3 SPARE-FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch-thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: ANSI Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
4. Fuse Pullers: For each size of fuse.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

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

3.2 FUSE APPLICATIONS

A. Service Entrance: Class L, time delay.

B. Feeders rated 600 Amperes or less: Class RK1, time delay.

C. Feeders rated 601 Amperes and above: Class L, time delay.

D. Motor Branch Circuits: Class RK1, time delay.

E. Large Motor Branch (601-4000 A): Class L, time delay.

F. Other Branch Circuits: Class RK1, time delay.

G. Control Transformer Circuits: Class CC, time delay, control transformer duty.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).

C. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by Owner.

3.4 IDENTIFICATION

A. Install labels complying with identification requirements in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch.

B. Install labels indicating Type and Rating of fuse installed on outside of door of each fused switch.

END OF SECTION 262813

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Bolted-pressure contact switches.
4. High-pressure, butt-type contact switches.
5. Molded-case circuit breakers.
6. Molded-case switches.
7. Enclosures.

## 1.2 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. GFEP: Ground-fault equipment protection.

C. HD: Heavy duty.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

## 1.3 PERFORMANCE REQUIREMENTS

A. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for all branches of emergency power. Refer to Division 26 Section "Overcurrent Protective Device Coordination Study" for additional requirements.

## 1.4 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

B. Simultaneous Action Submittals: Enclosed Switches and Circuit Breaker Product Data submittal shall be made in conjunction with action submittals required under Division 26 Section "Overcurrent Protective Device Coordination Study." The release of electrical equipment submittals (panelboards, engine generators, switchgear, etc.) is dependent on the receipt of a complete and accurate overcurrent protective device coordination study. The Architect and Engineer require a full submittal review period as delineated in Division 01 Section "Submittal Procedures" to adequately review the OCPD study against the submitted electrical components prior to release of submittals for equipment procurement. The submittal schedule required by Division 01 requirements shall provide for this review time in the action submittal process. Delay claims arising due to Contractor's failure to coordinate simultaneous action submittals will not be considered by the Owner.

C. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
2. Time-current curves for each type of overcurrent protection device. Include hardcopy of characteristic curve and TCC Number for use with Power Tools by SKM Systems Analysis, Inc. Indicate available setting points and selectable ranges for each type of adjustable circuit breaker.

D. Shop Drawings: For each enclosed circuit breaker, switch and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of device and overcurrent protective devices.

2. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's routine maintenance requirements for enclosed switches and circuit breakers and all installed components.
2. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

3. Time-current curves, including selectable ranges for each type of circuit breaker. Include directory listing each adjustable breaker included in the Work and their final set points.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories through one source from a single manufacturer, unless otherwise indicated.

1. Breaker Manufacturer: Manufacturer for breakers shall be the same as the manufacturer of other breakers proposed for other portions of the Work.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. Product Options: Drawings indicate spatial allocation for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum spatial allocation. Refer to Division 01 Section "Product Requirements."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Prepare equipment for shipment.

1. Provide suitable crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
2. Weatherproof equipment for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.

B. Installation Pathway: Coordinate delivery of equipment to allow movement into designated space.

1. Deliver in shipping splits in sizes that can be moved past obstructions in delivery path.
2. Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving equipment into place.

C. Store equipment indoors in clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.

D. Handle equipment components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Electric Service: Comply with requirements defined in Division 26 Section "Common Work Results for Electrical".

B. Field Measurements: Indicate field measurements on Shop Drawings where equipment is proposed for installation in existing spaces.

C. Environmental Limitations: Rate equipment for continuous operation at indicated ampere ratings for the following conditions:

1. Ambient Temperature for Circuit Breakers: Not less than 23 deg F and not exceeding 122 deg F.

2. Altitude: Not exceeding 6600 feet (2000 m).

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate ratings with utilization equipment nameplate limitations of maximum overcurrent protection device size. Provide enclosed switch or circuit breakers to match utilization equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Consumer and Industrial Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Fusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

E. Fuses are specified in Division 26 Section "Fuses."

2.3 FUSED POWER CIRCUIT DEVICES

A. Bolted-Pressure or High-Pressure, Butt-Type Contact Switch: UL 977; operating mechanism shall use either a rotary-mechanical-bolting action to produce and maintain high-clamping pressure on the switch blade after it engages the stationary contacts or butt-type contacts and a spring-charged mechanism to produce and maintain high-contact pressure when switch is closed.

1. Manufacturers:

a. Eaton Corporation; Cutler-Hammer Products.
b. General Electric Co.; Consumer and Industrial Division.
c. Pringle Electrical Mfg. Co.
d. Siemens Energy & Automation, Inc.
e. Square D/Group Schneider.

2. Main Contact Interrupting Capability: Twelve times the switch current rating, minimum.
3. Operating Mechanism: Manual handle operation to close switch stores energy in mechanism for closing and opening.

a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
b. Mechanical Trip: Operation of mechanical lever or push button or another device causes switch to open.

4. Auxiliary Switches: Factory installed, SPDT, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.

5. Service-Rated Switches: Labeled for use as service equipment.

6. Ground-Fault Relay: Comply with UL 1053. Self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.

a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground fault indicator.
b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
c. No-Trip Relay Test: Operation of "no-trip" test control permits ground-fault simulation test without tripping switch.
d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).

7. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.

B. Fuses are specified in Division 26 Section "Fuses."

2.4 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Series–rated devices are not permitted.

C. Molded-Case Circuit Breaker Requirements: UL 489, NEMA AB 3, with interrupting capacity rating to meet available fault current.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic trip-unit circuit breakers: RMS sensing, field-replaceable rating plug, and the following field-adjustable settings:

a. Long- and short-time pickup levels.
b. Long- and short-time time adjustments.
c. Instantaneous trip.
d. Ground-fault pickup level, time delay, and $I^2t$ response, where indicated.
e. Ground-fault indication alarm, where indicated.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.

6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity. Provide as indicated and as required by NFPA 70 for personnel protection.
7. GFEP Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity. Provide as indicated and as required by NFPA 70 for equipment protection.

D. Molded-Case Circuit-Breaker Features: Standard frame sizes, trip ratings, and number of poles. Provide the following features for all included in the Work:

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material; UL 486 B listed, dual rated and marked for use with copper- or aluminum load-side conductors.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Lock-Out Tag Provisions: For installing at least three Lock-Out tags on each circuit breaker to secure the breaker and prevent movement mechanism.

4. Communication Capability: Communication module with functions and features compatible with power monitoring and control system specified in Instrumentation paragraph Part 2 – Products of this Section

E. Circuit-Breaker Accessories: Standard frame sizes, trip ratings, and number of poles. Provide the following accessories where indicated:

1. Ground-Fault Protection: Provide integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2. Shunt Trip: Set to trip at 55 percent of rated voltage, where indicated.
3. Communication Capability: Communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
4. Key Interlock Kit: where indicated, provide to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

5. Under-voltage Trip Devices: Adjustable time-delay and pickup voltage.
6. Auxiliary Switch: where indicated, provide two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
7. Remote trip indication and control.

F. Molded-Case Switch Requirements: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

G. Molded-Case Switch Features and Accessories:

1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.

1. Under-voltage Trip Devices: Adjustable time-delay and pickup voltage.
2. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
3. Key Interlock Kit: Externally mounted to prohibit operation; key shall be removable only when switch is in off position.

## 2.5 ELEVATOR SHUNT-TRIP DISCONNECT SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products – ES Elevator Switch
2. Cooper Bussmann, Inc. Model - Power Module Switch - PS
3. Littelfuse, Inc. Model - LPS Series Elevator POWR-Switch

B. Fusible Switch with Shunt-Trip: Manufactured unit that combines fused disconnect switch with all necessary relay(s), control transformer and other options, required to provide disconnecting means and fire protection shunt-trip interface for elevator controller.

1. Ampere Rating: As required by elevator manufacturer for elevator proposed for inclusion in the Work.

2. Short-Circuit Current Rating: 200,000A.
3. Interlocks to prevent the opening of the cover when the switch is in the ON position. Interlock shall be defeatable for testing purposes.
4. Handle: lockable in the OPEN/OFF position.
5. Control Power Transformer: Integral 100VA rated with primary and secondary fuses. Primary voltage rating of 480 VAC with a 120 VAC secondary.
6. Isolation relay (3PDT, 10amp, 120V): Provide isolation relay with 120V AC or 24V DC coil as required to coordinate fire alarm system.

    a. Coordinate a normally open dry contact to energize the isolation relay and activate the shunt trip solenoid (140VA inrush at 120V); relay provided under Division 28 Section "Fire Alarm System". If 24V DC coil is selected, a separate 24V DC source and contact shall be provided by the Fire Alarm Safety System.

7. Provide options as follows:

    a. Key to Test Switch
    b. Pilot Light indicating systems is in the CLOSED/ON position.
    c. Isolated Full Capacity Neutral Lug
    d. For hydraulic elevators with automatic recall: Provide one pole normally closed Mechanical Interlock.
    e. Fire Alarm Voltage Monitoring Relay; Comply with NFPA 72.

2.6 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location as follows, unless otherwise indicated:

1. Indoor Locations: NEMA 250, Type 1.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Outdoor Locations: NEMA 250, Type 3R.
4. Within 50 feet of cooling towers: NEMA 250, Type 4X, stainless steel.
5. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

B. Enclosure Finish for Outdoor Units: Factory-applied finish in manufacturer's standard ANSI Gray enamel over corrosion-resistant treatment or rust-inhibiting primer coat, undersurfaces treated with corrosion-resistant undercoating.

C. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard ANSI Gray enamel over corrosion-resistant treatment or rust-inhibiting primer coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces where equipment will be installed for compliance with installation tolerances, required clearances, and other conditions affecting performance.

B. Examine roughing-in of conduits to verify the following:

1. Wiring entries comply with layout requirements.

2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders will have to cross section barriers to reach load or line lugs.

C. Verify that ground connections are in place and that requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met.

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

3.2 APPLICATION

A. Fused Power Circuit Device Operating Mechanism: Mechanical Trip, except Electrical Trip for switches with ground-fault protection or remotely tripped switches.

B. Molded-Case Circuit Breakers OCPD Type: Thermal-Magnetic Circuit Breakers, unless otherwise indicated.

3.3 INSTALLATION

A. Install and anchor equipment level on concrete bases, 4-inch nominal thickness. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.

B. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Comply with mounting and support requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated.

F. Anchor floor-mounting switches to concrete base.

G. Mount top of trim 74 inches above finished floor, unless otherwise indicated.

H. Mount plumb and rigid without distortion of box. Mount recessed equipment with fronts uniformly flush with wall finish.

I. Install overcurrent protective devices, controllers, and instrumentation.

J. Install filler plates in unused spaces.

K. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

L. Close unused conduit opening or other unused holes in sides of box with proper mating blank-off plates.

M. Do not use gutters of equipment as raceways for routing feeder conductors from bottom entrance to top-feed lugs or vice versa; an external gutter or conduit shall be used for this purpose.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

B. Enclosure Nameplates: Label each enclosure with engraved Equipment Identification Label as specified in Division 26 Section "Identification for Electrical Systems."

3.5 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.6 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each equipment bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.
3. Verify switch and relay type and labeling verification.
4. Verify rating of installed fuses.
5. Assist in field testing of equipment including pre-testing and adjusting of equipment and components.

B. Perform the following field tests and inspections and prepare test reports:

1. Inspect equipment installation, including wiring, components, connections, and equipment. Test and adjust components and equipment.
2. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 26 Sections.

3. Infrared Scanning: Perform Thermographic Survey in accordance with NETA ATS, Section 9.0.

a. Initial Infrared Scanning: Within 60 Days after Substantial Completion, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors and covers so connections are accessible to portable scanner.
b. Instruments, Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Complete installation and startup checks according to manufacturer's written instructions.

C. Correct Deficiencies, Retest and Report:

1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace conductors, units, and devices as required to bring system into compliance.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Prepare a report that identifies switchboards, units, conductors and devices checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.7 ADJUSTING

A. Set field-adjustable overcurrent protection device trip characteristics according to settings provided by Engineer-of-Record.

1. Settings will be provided by Engineer-of-Record after the submittal process and review of report required by Division 26 Section "Overcurrent Protective Device Coordination Study." are completed.

3.8 CLEANING

A. Clean components according to manufacturer's written instructions.

B. Prior to installation of front trim and cover plates inspect interior surfaces and perform the following:

1. Remove paint splatters and other spots.
2. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

C. On completion of front trim and cover installation, inspect exterior surfaces and perform the following:

1. Remove paint splatters and other spots.
2. Remove all temporary markings and labels.
3. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
4. Repair exposed surfaces to match original finish.

3.9 PROTECTION

A. Temporary Heating: Maintain a clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Apply temporary heating as required.

B. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's management and maintenance personnel to adjust, operate, and maintain enclosed switches and circuit breakers, overcurrent protective devices, instrumentation, and accessories. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

**TIPS:**

To view non-printing **Editor's Notes** that provide guidance for editing, click on MasterWorks/Single-File Formatting/Toggle/Editor's Notes.

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes separately enclosed, preassembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

B. Related Requirements:

1. Section 262419 "Motor-Control Centers" for VFCs installed in motor-control centers.

1.3 DEFINITIONS

A. CE: Conformite Europeene (European Compliance).

B. CPT: Control power transformer.

C. DDC: Direct digital control.

D. EMI: Electromagnetic interference.

E. LED: Light-emitting diode.

F. NC: Normally closed.

G. NO: Normally open.

H. OCPD: Overcurrent protective device.

I. PID: Control action, proportional plus integral plus derivative.

J. RFI: Radio-frequency interference.

K. VFC: Variable-frequency motor controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFC indicated.

1. Include dimensions and finishes for VFCs.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each VFC indicated.

1. Include mounting and 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. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Required working clearances and required area above and around VFCs.
2. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements.
3. Show support locations, type of support, and weight on each support.
4. Indicate field measurements.

B. Qualification Data: For testing agency.

C. Seismic Qualification Data: Certificates, for each VFC, accessories, and components, from manufacturer.

1. Certificate of compliance.
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.

D. Product Certificates: For each VFC from manufacturer.

E. Harmonic Analysis Report: Provide Project-specific calculations and manufacturer's statement of compliance with IEEE 519.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and motor-circuit protector trip settings.
b. Manufacturer's written instructions for setting field-adjustable overload relays.
c. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
d. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

e. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.
f. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

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. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace VFCs 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 MANUFACTURERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.2 SYSTEM DESCRIPTION

A. General Requirements for VFCs:

1. VFCs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508A.

B. Application: Constant torque and variable torque.

C. VFC Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors, as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

D. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

E. Output Rating: Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

F. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
2. Input AC Voltage Unbalance: Not exceeding 3 percent.

3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
4. Minimum Efficiency: 96 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or speed condition.

6. Minimum Short-Circuit Current (Withstand) Rating: 10 kA.

7. Ambient Temperature Rating: Not less than 32 deg F (0 deg C) and not exceeding 104 deg F (40 deg C).
8. Humidity Rating: Less than 95 percent (noncondensing).
9. Altitude Rating: Not exceeding 3300 feet (1000 m).

10. Vibration Withstand: Comply with NEMA ICS 61800-2.

11. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
12. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
13. Speed Regulation: Plus or minus 5 percent.

14. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
15. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

G. Inverter Logic: Microprocessor based, 16 bit, isolated from all power circuits.

H. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.

1. Signal: Electrical.

I. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: 0.1 to 999.9 seconds.
4. Deceleration: 0.1 to 999.9 seconds.
5. Current Limit: 30 to minimum of 150 percent of maximum rating.

J. Self-Protection and Reliability Features:

1. Surge Suppression: Factory installed as an integral part of the VFC, complying with UL 1449 SPD, Type 1 or Type 2.
2. Surge Suppression: Field-mounted surge suppressors complying with Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits," UL 1449 SPD, Type 2.
3. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
4. Under- and overvoltage trips.
5. Inverter overcurrent trips.
6. VFC and Motor-Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
7. Critical frequency rejection, with three selectable, adjustable deadbands.
8. Instantaneous line-to-line and line-to-ground overcurrent trips.

9. Loss-of-phase protection.
10. Reverse-phase protection.
11. Short-circuit protection.
12. Motor-overtemperature fault.

K. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

L. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

M. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

N. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

O. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

P. Integral Input Disconnecting Means and OCPD: UL 489, instantaneous-trip circuit breaker UL 489, thermal-magnetic circuit breaker with pad-lockable, door-mounted handle mechanism.

1. Disconnect Rating: Not less than 115 percent of VFC input current rating.
2. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.

3. Auxiliary Contacts: NO or NC, arranged to activate before switch blades open.

4. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
5. NC alarm contact that operates only when circuit breaker has tripped.

## 2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: VFCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. The designated VFCs shall be tested and certified by an NRTL as meeting the ICC-ES AC 156 test procedure requirements.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."

## 2.4 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.

5. Overcurrent.
6. External fault.
7. .

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.

   a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last four faults with time and date stamp for each.

D. Indicating Devices: Digital display mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac).

E. Control Signal Interfaces:

1. Electric Input Signal Interface:

   a. A minimum of two programmable analog inputs: 0- to 10-V dc Operator-selectable "x"- to "y"-mA dc.
   b. A minimum of six multifunction programmable digital inputs.

2. Pneumatic Input Signal Interface: 3 to 15 psig (20 to 104 kPa).
3. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the DDC system for HVAC or other control systems:

   a. 0- to 10-V dc.

b. 4- to 20-mA dc.
c. Potentiometer using up/down digital inputs.
d. Fixed frequencies using digital inputs.

4. Output Signal Interface: A minimum of one programmable analog output signal(s) (0- to 10-V dc operator-selectable "x"- to "y"-mA dc), which can be configured for any of the following:

a. Output frequency (Hz).
b. Output current (load).
c. DC-link voltage (V dc).
d. Motor torque (percent).
e. Motor speed (rpm).
f. Set point frequency (Hz).

5. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

a. Motor running.
b. Set point speed reached.
c. Fault and warning indication (overtemperature or overcurrent).
d. PID high- or low-speed limits reached.

F. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.

1. Number of Loops: One.

G. Interface with DDC System for HVAC: Factory-installed hardware and software shall interface with DDC system for HVAC to monitor, control, display, and record data for use in processing reports. VFC settings shall be retained within VFC's nonvolatile memory.

1. Hardwired Points:

a. Monitoring: On-off status.
b. Control: On-off operation.

2. Communication Interface: Comply with ASHRAE 135. Communication shall interface with DDC system for HVAC to remotely control and monitor lighting from a DDC system for HVAC operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through the DDC system for HVAC.

## 2.5 LINE CONDITIONING AND FILTERING

A. Input Line Conditioning: Based on the manufacturer's harmonic analysis study and report, provide input filtering, as required, to limit total demand (harmonic current) distortion and total harmonic voltage demand at the defined point of common coupling to meet IEEE 519 recommendations.

B. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2.

2.6 BYPASS SYSTEMS

A. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.

B. Bypass Mode: Manual operation only; requires local operator selection at VFC. Transfer between power converter and bypass contactor, and retransfer shall only be allowed with the motor at zero speed.

C. Bypass Mode: Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic-control system feedback.

D. Bypass Controller: Two-contactor-style bypass allows motor operation via the power converter or the bypass controller.

1. Bypass Contactor: Load-break, NEMA-rated contactor.
2. Output Isolating Contactor: Non-load-break, NEMA-rated contactor.

3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

E. Bypass Controller: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller arranged to isolate the power converter input and output and permit safe testing of the power converter, both energized and de-energized, while motor is operating in bypass mode.

1. Bypass Contactor: Load-break, NEMA-rated contactor.
2. Input and Output Isolating Contactors: Non-load-break, NEMA-rated contactors.

3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

F. Bypass Contactor Configuration: Full-voltage (across-the-line) type.

1. NORMAL/BYPASS selector switch.

2. HAND/OFF/AUTO selector switch.
3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
4. Contactor Coils: Pressure-encapsulated type.

a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.

5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses Insert source of control power, with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.

   a. CPT Spare Capacity: 50 VA.

6. Overload Relays: NEMA ICS 2.

   a. Melting-Alloy Overload Relays:

      1) Inverse-time-current characteristic.
      2) Class 10 tripping characteristic.
      3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

   b. Bimetallic Overload Relays:

      1) Inverse-time-current characteristic.
      2) Class 10 tripping characteristic.
      3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

      4) Ambient compensated.
      5) Automatic resetting.

   c. Solid-State Overload Relays:

      1) Switch or dial selectable for motor-running overload protection.
      2) Sensors in each phase.
      3) Class 10 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

      4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
      5) Analog communication module.

   d. NC isolated overload alarm contact.
   e. External overload, reset push button.

## 2.7 OPTIONAL FEATURES

A. Multiple-Motor Capability: VFC suitable for variable-speed service to multiple motors. Overload protection shuts down VFC and motors served by it, and generates fault indications when overload protection activates.

   1. Configure to allow two or more motors to operate simultaneously at the same speed; separate overload relay for each controlled motor.
   2. Configure to allow two motors to operate separately; operator selectable via local or remote switch or contact closures; single overload relay for both motors; separate output magnetic contactors for each motor.

3. Configure to allow two motors to operate simultaneously and in a lead/lag mode, with one motor operated at variable speed via the power converter and the other at constant speed via the bypass controller; separate overload relay for each controlled motor.

B. Damper control circuit with end-of-travel feedback capability.

C. Sleep Function: Senses a minimal deviation of a feedback signal and stops the motor. On an increase in speed-command signal deviation, VFC resumes normal operation.

D. Motor Preheat Function: Preheats motor when idle to prevent moisture accumulation in the motor.

E. Firefighter's Override (Smoke Purge) Input: On a remote contact closure from the firefighter's control station, this password-protected input:

1. Overrides all other local and external inputs (analog/digital, serial communication, and all keypad commands).

2. Forces VFC to operate motor, without any other run or speed command, at a field-adjustable, preset speed.
3. Forces VFC to transfer to bypass mode and operate motor at full speed.
4. Causes display of override mode on the VFC display.
5. Reset VFC to normal operation on removal of override signal automatically.

F. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

G. Remote digital operator kit.

H. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

2.8 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 3R.
3. Other Wet or Damp Indoor Locations: Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

B. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFC as "Plenum Rated."

2.9 ACCESSORIES

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.

1. Push Buttons: Covered
2. Pilot Lights: Push to test.
3. Selector Switches: Rotary type.

4. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

B. NC bypass contactor auxiliary contact(s).

C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

E. Supplemental Digital Meters:

1. Elapsed-time meter.
2. Kilowatt meter.
3. Kilowatt-hour meter.

F. Breather and drain assemblies, to maintain interior pressure and release condensation in NEMA 250, Type 4 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

G. Space heaters, with NC auxiliary contacts, to mitigate condensation in NEMA 250, Type 3R enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

H. Cooling Fan and Exhaust System: For NEMA 250, Type 1; UL 508 component recognized: Supply fan, with composite intake and exhaust grills and filters; 120-V ac; obtained from integral CPT.

I. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

J. Spare control-wiring terminal blocks; wired.

## 2.10 SOURCE QUALITY CONTROL

A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.

1. Test each VFC while connected to its specified motor.
2. Verification of Performance: Rate VFCs according to operation of functions and features specified.

B. VFCs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work

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

3.2 INSTALLATION

A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Floor-Mounting Controllers: Install VFCs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Roof-Mounting Controllers: Install VFC on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.

1. Curbs and roof penetrations are specified in Section 077200 "Roof Accessories."
2. Structural-steel channels are specified in Section 260529 "Hangers and Supports for Electrical Systems."

D. Seismic Bracing: Comply with requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

F. Install fuses in each fusible-switch VFC.

G. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

H. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.

I. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

J. Comply with NECA 1.

3.3 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices and facility's central-control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.
2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

3.4 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each VFC with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.

4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

8. Perform the following infrared (thermographic) scan tests and inspections, and prepare reports:

   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each VFC. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each VFC 11 months after date of Substantial Completion.
   c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. VFCs will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

## 3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

## 3.7 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers.

E. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573.16 "Coordination Studies."

F. Set field-adjustable pressure switches.

3.8 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 262923

# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Interior luminaires, lamps, and ballasts.
2. Solid State luminaires, and drivers.
3. Fiber Optic Luminaires and illuminators.
4. Emergency lighting units.
5. Exit signs.
6. Luminaire supports.

B. Related Sections include the following:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multi-pole lighting relays and contactors.
2. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps, snap switches and switch-box occupancy sensors.

## 1.2 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated Color Temperature.

C. CRI: Color-rendering index.

D. CU: Coefficient of utilization.

E. FMG: FM Global (formally Factory Mutual).

F. HID: High-intensity discharge.

G. LED: Light emitting diode.

H. LER: Luminaire efficacy rating.

I. Luminaire: Complete Lighting unit including, housing, lamps, reflector, socket, wiring, diffuser, and ballast and ballast housing where applicable.

J. RCR: Room cavity ratio.

K. Solid State: Lighting products that use semiconductor light-emitting diodes (LEDs), organic light-emitting diodes (OLED), or polymer light-emitting diodes (PLED) as sources of illumination rather than electrical filaments, plasma, or gas.

L. TM-21 L70: The time it takes a Luminaire to reach 70% Lumen maintenance based on extrapolations from LM-80-08 date using the approved methods required in IESNA Technical Memorandum 21 (TM-21).

1.3 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

B. Product Data: For each type of luminaire, arranged in order of fixture designation. Include data on features, accessories, finishes and the following:

1. Physical description of luminaire including dimensions.
2. Emergency lighting units including battery and charger.
3. Performance data for Ballast.
4. Energy-efficiency data.
5. Life, output, and energy-efficiency data for lamps.
6. Photometric data, in IESNA LM-63-2002 format, based on laboratory tests of each luminaire type, outfitted with lamps, ballasts, and accessories identical to those indicated for the luminaire as applied in this Project.

   a. Provide optical performance, polar diagrams, and relevant luminance and illuminance photometric data.
   b. Photometric data shall be certified by a qualified independent testing agency or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
   c. LM-79 luminaire photometric reports for Solid State luminaires.The test laboratory must hold National Voluntary Laboratory Accreditation Program (NVLAP) accreditation for the IES LM-79 test procedure or must be qualified, verified, and recognized through the U.S. Department of Energy's CALiPER program.

7. Solid State Luminaire reliability reports indicating that the manufacturer of the LED (chip, diode, or package) has performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows:

   a. High Temperature Operating Life (HTOL).
   b. Room Temperature Operating Life (RTOL).
   c. Low Temperature Operating Life (LTOL).
   d. Powered Temperature Cycle (PTMCL).
   e. Non-Operating Thermal Shock (TMSK).
   f. Mechanical shock.
   g. Variable vibration frequency.
   h. Solder Heat Resistance (SHR).

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit Reflected Ceiling Coordination Drawings in accordance with Division 26 Section "Common Work Results for Electrical."

   1.

B. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.

C. Qualification Data: For agencies providing photometric data for luminaires.

D. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and accessories to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:

1. Manufacturer's routine maintenance requirements for lighting and all installed components.
2. Special Lamp and Ballast disposal requirements; including manufacturer's safety data sheet with EPA requirements.
3. Lamp and Ballast Summary: Prepare a tabulation of lamps and ballast used on project; include part numbers and ordering information.

B. Warranties: Special warranties specified in this Section. Include registration information for Lamp and Ballast Specialty Warranty Programs (i.e. Sylvania Quick60+®, Advance PLUS 90 Protection®, etc).

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Specialty Incandescent lamps: Exact distribution of lamps will not be known until Final Aiming and Adjustment; therefore, furnish 25 for every 100 each type and rating required as "spot" distribution and 25 for every 100. "flood" distribution.
3. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
4. Battery and Charger Data: One for each emergency lighting unit.
5. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
6. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.
7. Exit Signs: 5 for every 100 of each type and installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

C. Source Limitations: All luminaries with the same type designation shall be obtained from a single manufacturer. Obtain similar luminarie types through one source from a single manufacturer, unless otherwise indicated.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Prepare products for shipment.

1. Provide suitable packaging materials, crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
2. Weatherproof packaging for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.

B. Store luminaires indoors in clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Protect products from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. Handle product components according to manufacturer's written instructions.

1.9 COORDINATION

A. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them, including but not limited to HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Fluorescent Ballast Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to replace ballasts replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period for Electronic Ballasts: 36 months from date of Substantial Completion.
2. Warranty Period for Fluorescent Electromagnetic Ballasts: 36 months from date of Substantial Completion.
3. Warranty Period for HID Electromagnetic Ballasts: 24 months from date of Substantial Completion.

C. Special Warranty for Fluorescent and HID Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 24 months from date of Substantial Completion.

D. Special Warranty for Solid State Power Supplies and Drivers: Manufacturer's standard form, made out to Owner and signed by manufacturer agreeing to replace power supplies or drivers that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

**1.** Warranty Period: 60 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide luminaires in accordance with the designations and descriptions in the "Luminaire Schedule" located on the Drawings. In Luminaire Schedule, products are listed below column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Where the Luminaire Schedule indicates only one product by manufacturer and associated catalog number and does not list other manufacturers by name; the design for each luminaire is based on the product named by manufacturer and associated catalog number scheduled. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Where the Luminaire Schedule indicates more than one manufacturer and associated catalog number; Subject to compliance with requirements, provide one of the products named by the manufacturers specified.
3. Basis-of-Design Product: Where the Luminaire Schedule indicates only one product by manufacturer and associated catalog number and lists other manufacturers by name only; the design for each luminaire is based on the product named by manufacturer and associated catalog number scheduled. Subject to compliance with requirements; provide either the named product or a comparable product by one of the other manufacturers specified.
4. Specific Product: Where the Luminaire Schedule indicates only one product by manufacturer and associated catalog number and does not list other manufacturers by name and includes the phrase "NO SUBSTITUTIONS ALLOWED"; the design for each luminaire is based on the product named by manufacturer and associated catalog number scheduled. Subject to compliance with requirements, provide the product named by the manufacturers specified. Provide a list of Unit Prices for these items in accordance with requirements of Division 01 Section "Unit Prices".

2.2 LUMINAIRES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

E. Solid State Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

F. Metal Parts: Free of burrs and sharp corners and edges.

G. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

H. 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.

I. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

J. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

K. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate luminaires with one filter on each ballast indicated to require a filter.

2.3 luminaire disconnecting means

A. Disconnect for Ballasted Luminaires: Provide a Factory-Installed in-line disconnecting means for ballasted luminaires. Provide disconnect at each luminaire. Locate disconnect internal or external to luminaire; for disconnects external to luminaire, disconnect shall be attached to the luminaire.

1. Available Manufacturers: Subject to compliance with requirements, provide Sta-Kon® Luminaire Disconnect manufactured by Thomas and Betts or similar products meeting requirement listed herein.

2.4 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Transformer Company; a Division of Phillips Electronics.
b. OSRAM Sylvania.
c. Universal Lighting Technologies.

B. Electronic Ballasts: Comply with ANSI C82.11; programmed-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.
2. Thermal Protection: Comply with UL Class P, Type 1 Outdoor.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 10 percent.
5. Transient Voltage Protection: ANSI/IEEE C62.41, Category A or better.
6. Operating Frequency: 42 kHz or higher.
7. Voltage Range: 108-305 Volts

8. Lamp Current Crest Factor: 1.7 or less.

9. BF: 0.85-0.89, unless noted otherwise.
10. Power Factor: 0.98 or higher.
11. Starting Temperature: 0 Deg C minimum, unless otherwise indicated.
12. Ballast Case Temperature: 70 Deg C maximum, unless otherwise indicated.
13. Remote Mounting Distance: Up to 20-feet, where indicated.
14. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

15. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

C. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.
2. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
3. Automatic lamp starting after lamp replacement.
4. Thermal Protection: Comply with UL Class P, Type 1 Outdoor.
5. Sound Rating: Class A.
6. Total Harmonic Distortion Rating: Less than 10 percent.
7. Transient Voltage Protection: ANSI/IEEE C62.41, Category A or better.
8. Operating Frequency: 40 kHz or higher.
9. Voltage Range: 108-305 Volts
10. Lamp Current Crest Factor: 1.7 or less.
11. BF: 0.95 or higher, unless otherwise indicated.
12. Power Factor: 0.98 or higher.
13. Starting Temperature: 0 Deg C minimum, unless otherwise indicated.
14. Ballast Case Temperature: 70 Deg C maximum, unless otherwise indicated.
15. Remote Mounting Distance: Up to 18-feet, where indicated.
16. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

D. Single Ballasts for Multiple Luminaires: Where indicated, provide Factory-wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

E. Ballasts for Low-Temperature Environments:

1.
2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.

F. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.

G. Ballasts for Dimmer-Controlled Luminaires: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

H. Ballasts for Bi-Level Controlled Luminaires: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.

   a. High-Level Operation: 100 percent of rated lamp lumens.
   b. Low-Level Operation: 50 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.5 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Advance Transformer Company; a Division of Phillips Electronics.
   b. OSRAM Sylvania.
   c. Universal Lighting Technologies.

B. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.
2. Lamp end-of-life detection and shutdown circuit.
3. Automatic lamp starting after lamp replacement.
4. Thermal Protection: Comply with UL Class P, Type 1 Outdoor.
5. Sound Rating: Class A.
6. Total Harmonic Distortion Rating: Less than 10 percent.
7. Transient Voltage Protection: ANSI/IEEE C62.41, Category A or better.
8. Operating Frequency: 20 kHz or higher.
9. Voltage Range: 108-305 Volts
10. Lamp Current Crest Factor: 1.7 or less.
11. BF: 0.95 or higher, unless otherwise indicated.
12. Power Factor: 0.98 or higher.
13. Starting Temperature: Minus 5 Deg F (Minus 20 Deg C) minimum, unless otherwise indicated.
14. Ballast Case Temperature: 75 Deg C maximum, unless otherwise indicated.
15. Remote Mounting Distance: Up to 18-feet, where indicated.
16. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

C. Ballasts for Dimmer-Controlled Luminaires, Electronic type:

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.6 EMERGENCY FLUORESCENT POWER UNIT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bodine Company, The.
b. IOTA Engineering, L.L.C.
c. Side Lite.

B. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast. Comply with UL 924.

1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.
2. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each, unless otherwise indicated. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

3. Night-Light Connection: Operate one fluorescent lamp continuously, unless otherwise indicated.
4. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

5. Battery: Sealed, maintenance-free, nickel-cadmium type.
6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

C. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from luminaire. Comply with UL 924.

1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.
2. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

3. Night-Light Connection: Operate one fluorescent lamp in a remote fixture continuously, unless otherwise indicated.
4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type.
6. Housing: NEMA 250, Type 1 enclosure.

7. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
8. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.7 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Chevrons: Fixture Schedule does not indicate chevron quantity or direction. Coordinate chevron arrows required with plans. Chevrons shall be external to the lettering on sign face.

C. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life use less than 5 watts of electricity.

2. Master/Remote Sign Configurations:

a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.8 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.

7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

8.

9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.9 LAMPS – GENERAL

A. General: Configurations and ratings as noted in Luminaire Schedule on Drawings.

1. Requirements: Comply with subparagraphs below for specific lamp types.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. General Electric;
b. OSRAM Sylvania;
c. Phillips;

2.10 Incandescent and Halogen Lamps

A. General: Configurations, beam pattern and ratings as noted in Luminaire Schedule on Drawings.

2.11 FLUORESCENT LAMPS

A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

B. T8 Linear, rapid start, energy saving, low-mercury lamps: 2-pin, CRI 85 (minimum), color temperature As Specified in Luminaire Schedule, and average rated life 36,000 hours, unless otherwise indicated.

1.
2. 28W: Nominal length of 48 inches (1220 mm), rated 2725 initial lumens (minimum).
3. 25W: Nominal length of 36 inches, rated 2250 initial lumens (minimum).
4. 17W: Nominal length of 24 inches, rated 1400 initial lumens (minimum).

C. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 82 (minimum), color temperature As Specified in Luminaire Schedule, average rated life of 12,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).

4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).
7. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
8. 70 W: T4, triple tube, rated 5500 initial lumens (minimum).

2.12 solid state lighting SYSTEMS

A. Solid State luminaires will comply with the requirements of the following standards:

1. ANSI/NEMA/ANSLG C78.377-2008 – American National Standard for the Chromaticity of Solid State Lighting Products.
2. LM-79-08, IESNA Approved Method for the Electrical and Photometric Measurements of Solid-Sate Lighting Products.
3. LM-80-08, IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources.

B. LED Chip Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Osram.
2. Philips – LumiLEDs.
3. Nichia.
4. Cree.
5. Seoul Semi-Conductor.
6. Xicato.
7. Bridgelux.

C. General: Provide Solid State systems and LED components meeting the following requirements:

1. Provide Solid State systems from same binning process to maintain color consistency.
2. Deliver all Solid State products at the same time and store on site to ensure that products have been produced from the same bin. Tolerances exceeding 200K will not be acceptable.
3. The Solid State Luminaires shall be operated at constant and carefully regulated current levels. LEDs shall not be overdriven beyond their specified nominal voltage and current.
4. Provide Electrical connections protected from reverse polarity. Provide high voltage protection in the event connections are reversed or shorted during the installation process.
5. Provide Solid State Luminaires and power/data supplies from a single manufacturer to ensure compatibility.
6. Provide all Solid State controls, peripheral devices, and software from a single manufacturer to ensure compatibility.
7. Conduct minimum eight-hour burn-in test during manufacturing on Solid State Luminaires (100% of each lot).

D. White & Static Color Solid State Systems: White LED sources must meet the following requirements:

1. Luminaires must be rated for -40°C to +50°C operation.
2. Duv tolerance of 0.001 ± 0.006.
3. Color Rendering Index (CRI): greater than or equal to 80.
4. Correlated Color Temperature (CCT) as Specified in Luminaire Schedule. Meet the following tolerance requirements for CCT specified:

   a. Nominal 2700K CCT: 2725 ± 50.
   b. Nominal 3000K CCT: 3045 ± 50.
   c. Nominal 3500K CCT: 3465 ± 50.
   d. Nominal 4000K CCT: 3985 ± 50.
   e. Nominal 4500K CCT: 4503 ± 50.
   f. Nominal 5000K CCT: 5028 ± 50.
   g. Nominal 5700K CCT: 5665 ± 50.
   h. Nominal 6500K CCT: 6530 ± 50.

E. Dynamic Color Changing Solid State Systems: RGB LED sources must meet the following requirements:

1. Luminaires must be rated for -40°C to +50°C operation.
2. Duv tolerance of 0.001 ± 0.006.
3. Color Rendering Index (CRI): greater than or equal to 80 for RGB mixed white.
4. Controllability:

   a. 8-bit control of red, green and blue LEDs to produce 16.7 million colors or more.
   b. Digital driver using high-speed pulse width modulation (PWM).
   c. Integral and differential nonlinear control.
   d. 14-bit or greater nonlinear scaling techniques for high-resolution output.
   e. Selectable means of external control via a data network.
   f. Support frame rates greater than 30 frames per second.
   g. Constant data transmission rates shall be employed, resulting in the output being independent of distance of cable between power supply and light source within the specified length.

F. Luminaire: Configurations, requirements and ratings are noted in Luminaire Schedule on Drawings. Correlated Color Temperature (CCT) is specified in Luminaire Schedule. Comply with subparagraphs below for specific luminaire types, unless otherwise indicated on Drawings:

1. Parking Garage Luminaires:

   a. Minimum Light Output: 2000 lumens, unless otherwise indicated.
   b. Allowable CCT per ANSI C78.377: Less than or equal to 5700K.
   c. CRI: Minimum of 50, unless otherwise indicated.
   d. TM-21 L70 Lumen Maintenance: 100,000 Hours.
   e. Minimum Luminaire Efficacy: 60 lumens / watt.
   f. Housing: IP56 rated.

2. Linear Panels, Linear Strips and Troffers:

   a. Minimum Light Output: 3000 lumens, unless otherwise indicated.
   b. Allowable CCT per ANSI C78.377: Less than or equal to 5700K.
   c. CRI: Minimum of 80, unless otherwise indicated.
   d. TM-21 L70 Lumen Maintenance: 50,000 Hours.
   e. Minimum Luminaire Efficacy: 65 lumens / watt.

3. High Bay and Low Bay Luminaires:

   a. Minimum Light Output: 10,000 lumens, unless otherwise indicated.
   b. Allowable CCT per ANSI C78.377: Less than or equal to 5700K.
   c. CRI: Minimum of 80, unless otherwise indicated.
   d. TM-21 L70 Lumen Maintenance: 50,000 Hours.
   e. Minimum Luminaire Efficacy: 70 lumens / watt.

4. Round and Square Aperture Downlights Luminaires:

   a. Minimum Light Output: 500 lumens, unless otherwise indicated.
   b. Allowable CCT per ANSI C78.377: Less than or equal to 5700K.
   c. CRI: Minimum of 80, unless otherwise indicated.
   d. TM-21 L70 Lumen Maintenance: 35,000 Hours.
   e. Minimum Luminaire Efficacy: 40 lumens / watt.

2.13 DRIVERS for solid state lighting

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lutron Electronics Co., Inc.
2. OSRAM Sylvania.

B. Description: Electronic programmed rapid-start type, complying with FCC Part 15 Class A or Class B, designed for type and quantity of LEDs indicated. Driver shall be designed for full light output and include dimming capability.

1. Compatibility: Certified by manufacturer for use with LED type provided.
2. Comply with UL 8750 Class 2.
3. Thermal Protection: Comply with UL Class P, Type 1 Outdoor.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: ANSI/IEEE C62.41, Category A or better.
7. Input Voltage Range: 108-305 Volts.
8. Output Voltage: not exceeding 60V (Complies with Class 2 for US).
9. Maximum inrush current: 2 amperes for 120V and 277V drivers.
10. Minimum Efficiency at Full Load: 85%.
11. Power Factor: 0.9 or higher.
12. Starting Temperature: Minus 5 Deg F (Minus 20 Deg C) minimum to 104 Deg F (40 Deg C), unless otherwise indicated.
13. Case Temperature: 75 Deg C maximum, unless otherwise indicated or used in LM70 reporting.
14. Housing: minimum IP20 rating for dry location installation, higher rating as required for exterior use.
15. Remote Mounting Distance: Up to 18-feet, where indicated.
16. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
17. Rated Life: minimum of 50,000 hours of rated lifetime at maximum operating conditions.
18. Dimmable with standard dimmers down to 1%. 0-10V, 3-wire, or 3. Forward Phase Control (neutral wire required) (Line Voltage Controlled) Dimming as required to be compatible with lighting control system specified.

2.14 LUMINAIRE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture, unless otherwise indicated.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture, unless otherwise indicated.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

H. Suspension Bar for Light Fixtures: Factory-fabricated metal hanger for supporting luminaires at locations between ceiling system t-grid components. Attached to ceiling tee bar with screws or integral clamp for stability. Includes tab for independent support wire attachment.

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

a. Cooper B-Line, Inc.; a division of Cooper Industries.
b. ERICO International Corporation.

PART 3 - EXECUTION

3.1 APPLICATION

A. Provide Ballasts for Low Electromagnetic-Interference Environments in the following locations:

1. Operating Rooms
2. Information Technology Rooms / Closets

3.2 INSTALLATION

A. Comply with NECA/IESNA 500 "Standard for Installing Indoor Commercial Lighting" as published by the National Electrical Contractors Association.

B. Comply with applicable portions of NECA/IESNA 502 "Standard for Installing Industrial Lighting Systems" as published by the National Electrical Contractors Association.

C. Refer to Architectural Reflected Ceiling Plans for locations of luminaires. Do not scale locations from Electrical Drawings.

D. Luminaires: Set level, plumb, and square with ceilings and walls. Install so as not to interfere with the installation or removal of adjacent ceiling panels.

E. Lamps: Install lamps in each fixture.

F. Ballasts: Provide multiple ballasts as required to accommodate multilevel switching indicated on Drawings.

G. Flanges: Verify the exact ceiling type and arrangement within which the luminaires will be installed with the Architectural reflected ceiling plans prior to procurement. Provide appropriate flanges and accessories with each luminaire to accommodate the defined ceiling.

H. Support for Luminaires in or on Grid-Type Suspended Ceilings: Use grid as a support element in conjunction with independent supports.

1. Support Clips: Fasten to luminaires and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.

2. Install at least two independent support rods or wires from structure to a tab on luminaire at opposite corners. For fixture over 48 inches (1220 mm) in length, provide intermediate independent supports at a minimum of 48 inches (1220 mm) on center. Wire or rod shall be independent of ceiling support system and shall have breaking strength of the weight of fixture at a safety factor of 3.
3. Fixtures of Sizes Less Than Ceiling Grid: Install fixture as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two factory-fabricated metal Suspension Bar for Light Fixtures spanning.

I. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swaying or other horizontal movement.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with stem hangers, unless otherwise indicated.
3. Fixtures Support Points: Where support points for suspended luminaires are required in locations between ceiling grip components, install at location indicated or in center in acoustical panel, and support with a factory-fabricated Tee Bar Grid Box Hanger spanning and secured to ceiling tees with integral factory-fabricated clamp.
4. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end, unless otherwise indicated.

J. Fiber Optic Lighting Systems:

1. Verify mounting locations for all illuminators and that manufacturer's ventilation requirements are met.
2. Verify installation of appropriate power service at location of all illuminators.
3. Verify exact lengths of cables.
4. Verify exact locations of end-lit fixtures.
5. Verify exact lengths of all fiber optic cable tails, their associated illuminators and fixtures.
6. Verify space behind fixtures allows for required fiber optic cable bending radius.
7. Install illuminators, fixture fittings and pre-assembled fiber optic cable harnesses per manufacturer's recommendations.
8. Pre-terminate all fiber optic cables into appropriate harness adapter at factory.

## 3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

## 3.4 CLEANING AND RELAMPING

A. Clean components according to manufacturer's written instructions.

B. After completing equipment installation and before substantial completion, inspect all luminaires and components.

1. Remove paint splatters and other spots, dirt, fingerprints and debris.
2. Repair damaged finish to match original finish.

3. Dust or Vacuum interiors of suspended indirect and pendant luminaires to remove all dust, dirt, and debris.
4. Clean all lenses with cleaning agent approved by Luminaire Manufacturer.
5. Verify all warning labels in fixtures do not obstruct any reflective surface. Relocate warning labels as necessary so that they are not in plain view, yet they are still accessible to qualified personnel during re-lamping.
6. Perform Lamp Burn-in procedure for all lamps as recommended by the lamp and ballast manufacturer prior to Final Acceptance.

3.5 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Verify transfer from normal power to battery and retransfer to normal by both of the following methods.

1. Interrupt power supply to demonstrate proper operation.
2. Depress Push-To-Test button to demonstrate proper operation.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 FOLLOW-UP SERVICE

A. Final Aiming and Adjusting: Perform adjustments to all aimable and track mounted luminaires as directed by the Architect to provide required light intensities and distributions.

1. Scheduling: After Substantial Completion, but not more than three months after Final Acceptance; after delivery and placement of amenities including but not limited to furniture, artwork, plantings, and signage/graphics; during a period mutually agreeable to the Architect and Owner.
2. Required Equipment: Provide scaffolding, ladders, motorized man-lifts or hoists as required to reach luminaires.
3. Re-Lamp: Utilizing the extra materials furnished under Part 1 above, re-lamp fixtures with new lamps having differing beam-spreads as directed by the Architect. Return all unused or minimally-used lamps to the facilities stock at the completion of the aiming and adjustment as directed by the Owner.

END OF SECTION 265100

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# SECTION 270500

# COMMON WORK RESULTS FOR COMMUNICATIONS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. The requirements contained in this Section apply to all Section of this Division.

B. Section Includes:

1. Common terminology and requirements used throughout this Division.
2. Requirements for Acceptance Testing Agency.
3. Requirements for Manufacturer Seismic Certification.
4. Requirements for Manufacturer Special Seismic Certification.
5. Communication equipment coordination and installation.
6. Sleeves for raceways and cables.
7. Sleeve seals.
8. Grout.
9. Common communication installation requirements.
10. Contractor Qualifications (Preapproved Bidder List).
11. Attachment A for Low Voltage Cable Bidding.

### 1.2 DEFINITIONS

A. AHJ: Authorities Having Jurisdiction.

B. Bound Material: Bound refers to materials permanently bound, as by stitching or glue, or materials securely fastened in their covers by multiple fasteners that penetrate all papers. Ring binders, spiral binders, brads and screw posts are acceptable fasteners. Loose papers clipped together or stapled at one corner are not acceptable.

C. Business Day: Where this Section and other Sections of this Division use the term "Business Day" it shall mean Monday thru Friday, excluding Holidays recognized by Federal, State and Local government.

D. Seismic Certification: Seismic certification refers to a manufacturer's certification for architectural, mechanical, and electrical components, supports, and attachments pursuant to ASCE/SEI 7-05 Section 13.2.1.2.

E. RS-232: A TIA standard for asynchronous serial data communications between terminal devices.

F. RS-485: A TIA standard for multipoint communications using two twisted-pairs.

G. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

1.3 PERFORMANCE REQUIREMENTS

A. The Drawings diagrammatically show the sizes and locations of various equipment and devices, and the sizes of the major interconnecting wires, without showing exact details as to elevations, offsets, and other installation requirements. Carefully layout the Work at the site to conform to the architectural and structural conditions, to avoid obstructions and to permit proper grading of pipe associated with other portions of the Work. In cooperation with other trades, determine the exact location of equipment and devices and connections thereto by reference to the submittals and rough-in drawings, and by measurements at the site. Make minor relocations necessitated by the conditions at the site, or directed by the Owner, without additional cost to the Owner.

1.4 SUBMITTAL PROCEDURES

A. These submittals must be provided 30 days prior to start of construction.

B. Common Requirements for Product Data: Where this Section and other Sections of this Division require Product Data to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Submit hardcopy of Product Data in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of product data submittals shall be bound materials as defined above. Separate products under distinct subheadings that correspond to paragraphs in specification text. Divide sections in binder with labeled divider tabs.
2. In addition to hardcopies required by Division 01, submit one copy of product data in electronic format. All files shall be in Portable Document Format (.pdf).
3. Product Data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.

C. Common Requirements for Shop Drawings: Where this Section and other Sections of this Division require Shop Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Prepare Shop Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®.
2. Submit hardcopy of Shop Drawings in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of Shop Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format. Files shall include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
4. Shop Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.

D. Common Requirements for Coordination Drawings: Where this Section and other Sections of this Division require Coordination Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" and Division 01 Section "Project Management and Coordination". In addition to the requirements of Division 01 comply with the following:

1. Prepare Coordination Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®. Drawings files must be composite with multiple distinctive layers for each of the various trades.
2. Submit hardcopy of Coordination Drawings in the quantity as required under Division 01. Hardcopies of Coordination Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format. Files shall include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
4. Coordination Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.

E. Common Requirements For Qualification Data:

1. Designer Qualifications: Where this Section and other Sections of this Division require an RCDD to be responsible for Delegated Design requirements; Submit Qualification data for BICSI Registered Communications Distribution Designer including, but not limited to, proof of registration.
2. Installer Qualifications: Where this Section and other Sections of this Division require cabling installer to have personnel certified by BICSI on staff; Submit certification documentation that demonstrates compliance with the Quality Assurance paragraph of this Section.

3. Independent Testing and Inspecting Agency Certification: Where this Section and other Sections of this Division require an Independent Testing and Inspecting agency to be responsible for Acceptance Testing and Field Quality Control requirements; Submit certification documentation for such agency that demonstrates compliance with the Quality Assurance paragraph of this Section.

1.5 ACTION SUBMITTALS

A. Product Data: Submit product data for each of the following.

1. Sleeves.
2. Sleeve seals.
3. Grout.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Designer, Installer, and Independent Testing and Inspecting Agency.

B. Quality Control: Proposed test forms for fiber riser, copper riser and horizontal UTP cable.

1. List of test equipment to be used for copper and fiber testing (i.e. Fluke, Pentascanner, etc.) List of all tests to be performed as a part of the certification process.

1.7 QUALITY ASSURANCE

A. Designer Qualifications: Shop Drawings shall be prepared and signed by personnel under the direct supervision of RCDD.

1. Documentation of manufacturer's current qualification of contractor as an approved BELDEN Certified System Vendor (CSV).

a. Provide references of a minimum of three completed BELDEN installations.
b. Provide number of BELDEN certified installers. Owner may request a list by name and proof of training.

2. Vendors shall be BELDEN/CDT [**Berk-Tek**][**CommScope**][**Draka USA**][**Genesis Cable**][**KRONE**][**Mohawk**][**Nordex/CDT**][**Superior Essex**][**SYSTIMAX**][**3M**][**Tyco Electronics/AMP Netconnect**] certified as a Certified System Vendor (CSV).
3. All Work shall be performed by certified technicians skilled in their respective trades as stated in this division.

B. Common Requirements for Independent Testing and Inspecting Agency Qualifications: Where this Section and other Sections of this Division call for an Independent Testing and Inspecting Agency (Testing Agency); the Testing Agency shall comply with the following requirements:

1. Have the experience and capability to conduct the testing indicated,
2. Be a member company of the InterNational Electrical Testing Association (NETA) or a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction and the Engineer-of-Record.
3. Meet the Requirements of NETA ATS 3.0 including, but not limited to, the following:

a. Be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated.
b. Be regularly engaged in the testing of seismic support of electrical equipment devices, installations, and systems.
c. Use technicians who are regularly employed for testing services.
d. Have a "Full Membership" classification issued by the InterNational Electrical Testing Association meets the above criteria.

4. Testing Agency's Field Personnel: Technicians performing specified electrical tests and inspections shall meet the Requirements of NETA ATS 3.0 including, but not limited to, the following:

a. Technicians performing specified electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgment on the serviceability of the specific equipment.
b. Technicians shall be certified in accordance with ANSI/NETA ETT-2000, Standard for Certification of Electrical Testing Personnel. Each on-site crew leader shall hold a current certification, Level III or higher, in electrical testing.

C. Common Requirements For Qualification Data:

1. Manufacturer Seismic Qualification Certification: Where this Section and other Sections of this Division require products to meet seismic requirements; Submit certification that equipment, devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems" Include the following:

a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Common Requirements for Material Quality: Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall be replaced with new materials, equipment or devices identical with those damaged, unless approved otherwise by the Owner in writing.

E. Common Requirements for Code Compliance: In case where differences occur between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. Perform the following:

1. Promptly notify the Architect in writing of any such difference.
2. Obtain approval from Architect before proceeding with the Work.
3. Should the Contractor perform any work that knowingly does not comply with local codes, laws and ordinances, industry standards, or other governing regulations; the Work shall be corrected at no cost to the Owner.

F. Common Requirements for Compliance with AHJ Instructions: In cases where the Authority Having Jurisdiction requires deviations from the requirements of the Contract Documents, perform the following:

1. Promptly notify the Architect in writing of any such difference.
2. Obtain approval from Architect before proceeding with the Work.

G. 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.

1. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided shall meet the requirements of the UL standard.

1.8 UNIT PRICES

**A. Provide pricing breakdown showing unit pricing for material and labor for each type of system installed along with bid documents. An <u>example</u> Appendix A form is included at the end of this section.**

**1. Match all part numbers to those used in the project and called out with in the Division 27 specifications.**
**2. Unit Pricing for material to include part numbers for each item proposed.**

B. **Bids will not be considered without the inclusion of the Appendix A document completely**

1.9 CLOSEOUT SUBMITTALS

A. Warranty: Special warranty specified in this Section.

B. Certification of level of performance as evidenced by comprehensive test results for fiber riser, copper riser and UTP horizontal cabling as specified in the Division 27 Specifications. Electronic and hard copy test results should be provided to the owner's LAN representative.

C. Record drawings with as-built information and finalized versions of the shop drawings. Numbered outlets in each room shall be shown on these drawings using a numbering scheme coordinated with the owner's LAN representative. These submittals shall be on the base plan as provided by the Architect or Owner.

1.10 PRODUCT SUBSTITUTIONS

A. Comply with provisions of Division 01 Section "Product Requirements".

1. If item of equipment or device offered as Substitution differs in dimension or configuration from that indicated in the Contract Documents, provide, as part of the substitution submittal, a drawing that shows that the equipment or devices proposed for Substitution can be installed in the space available without interfering with other trades or with access requirements for operations and maintenance in the completed project. Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.
2. Where substitute equipment or devices requires different arrangement or connections from that indicated in the Contract Documents, install the equipment or devices to operate properly and in accordance with the requirements of the Contract Documents. Make incidental changes necessary in piping, ductwork or wiring which results from the inclusion of the substitute equipment or device without any additional cost to the Owner. Pay all additional costs incurred by other trades in connection with changes required by the inclusion of the substituted equipment or device in the Work.

1.11 PROJECT CONDITIONS

A. Interruption of Existing Telecommunications Service: Do not interrupt communications service, including but not limited to: telephone, data, fiber, television or other communication service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary telecommuncations service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than five business days in advance of proposed interruption of telecommuncation services.
2. Do not proceed with interruption of telecommunication services without Construction Manager's and Owner's written permission.

B. Schedule of Work in Existing Facilities:

1. The building will continue in use throughout the construction period, carry out the Work in such a manner as to minimize disturbance to the occupants and be familiar with construction standards for performing the Work under these conditions.
2. The schedule contemplates working in designated areas in the existing building while other adjacent areas are still being occupied. Carry out the Work in such a manner as to minimize disturbance to those occupied areas.

3. Should the Work in the designated areas affect any services to the areas that are to remain in use, new permanent or temporary services or a combination of both shall be installed as required to enable those occupied areas to function properly and without interruption.
4. Perform no work in the existing building which would interfere with its use during normal hours of occupancy, Including but not limited to operations which would cause objectionable noise or service interruptions, unless special permission is granted by the Owner.
5. Adhere to the owner's Infection Control Risk Assessment procedures.

C. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving large equipment into place. Where any piece of equipment is too large for ingress through normal building openings it shall be placed in its containing space before the enclosing structure is completed.

D. The contractor will be responsible for any damage caused, either to the physical structure or existing communications cables or systems. Any damage will be repaired as a part of the basic service to be provided under this specification, at no additional cost to the owner.

1.12 COORDINATION

A. In describing various materials, equipment and devices, in general each item may be described singularly, even though there may be a multiplicity of identical items. Also, where the description is general in nature, the exact sizes, duties, space arrangements, horsepower and other requirements must be obtained by reference to other portions of Contract Documents.

B. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer. Verify that all materials, equipment and devices proposed for use on this Project are within the constraints of the allocated space.

C. Coordinate arrangement, mounting, and support of communication equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping, ductwork and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

D. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

E. Utility Service Coordination:

1. Telecommunications Services: Coordinate the location of the telephone, data, fiber, cable television and the entrance of other telecommunications services with the respective franchise utility company and with all other trades. Provide materials and equipment required to connect these telecommunications service.

F. Coordinate location of access panels and doors for communicationl items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

G. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

H. For roof-mounted equipment: Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.13 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of telecommunications equipment and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Twenty Five years parts and labor from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

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

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The Drawings do not indicate existing installations other than to identify modifications or extensions thereto. Visit the site and ascertain the existing conditions. Review construction details of the existing portion of the building during the site inspection. Include all work required to remove or modify portions of the existing installation in order to accommodate the new Work. Failure to comply with this will not be considered grounds for additional payment in connection with removing or modifying any part of the existing installation or installing any new or temporary work.

3.2 TEMPORARY WORKING ACCESS

A. Remove existing wire, conduit, equipment, and other items as required to provide access for Work in existing facilities.

B. Reinstall and refinish items removed, or otherwise damaged, to match existing adjacent conditions upon completion of the Work.

3.3 SALVAGE, DEMOLITION AND RELOCATION

A. Modify, remove, salvage, or relocate materials, equipment and devices as indicated or required by the installation of new Work.

B. Salvage and Demolition: Working jointly with the Owner's Representative, establish and mark salvage and demolition items before commencing work; report items scheduled for relocation, reinstallation or reuse, which are found to be in damaged condition; await further instructions from the Owner before commencing Work.

1. Demolition material shall be removed from the site and disposed of in a legal manner.
2. Salvaged equipment and devices shall be the property of the Owner, unless otherwise indicated. Store salvaged items in locations as directed by Owner.
3. For devices and equipment marked for demolition, remove all conduit and wiring back to the point of origination, unless otherwise indicated.
4. Where existing walls are demolished, remove all existing communcation devices, their associated conduit and wiring back to the point of origination.
5. Maintain service to all "existing to remain" devices and equipment that may be interrupted during demolition.
6. Upon completion of demolition, ensure that remaining devices that may have been interrupted during demolition are in working order.

C. Relocations: Make minor relocations necessitated by the conditions at the site or as directed by the Owner's Representative, without additional cost to the Owner.

1. Remove items which are to be relocated in reverse order to original assembly or placement.
2. Protect items until relocation is complete.
3. Clean, Repair and restore to good functional condition, equipment, materials and items scheduled for relocation. Provide new fittings and appurtenances required to complete the relocations and to restore to good operating order.

D. Substitution of New materials for Relocation: New materials of similar design and quality may be substituted for materials and items indicated to be relocated upon approval of Owner and Architect. Comply with Division 01 for Substitution Procedures.

3.4 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. One hard copy of final as-built shop drawings shall be placed within each Telecommunications Room/IDF and Main Computer Room/MDF with outlets numbers indicated.

B. All materials, equipment and devices shall be installed in accordance with the recommendations of the manufacturer and in the best standard practice to bring about results of a first class condition.

C. All materials, equipment and devices shall be installed in accordance with the recommendations of their manufacturer.

D. Comply with NECA 1 - Standard Practices for Good Workmanship in Electrical Construction, as published by the National Electrical Contractors Association.

E. Use licensed technicians skilled in their respective trades for installation of the Work.

F. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items, unless otherwise indicated.

G. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

H. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communication equipment and other nearby installations. Connect in such a manner as to facilitate future disconnecting with minimum interference with other items in the vicinity.

I. Right of Way: Give to piping systems installed at a required slope.

J. Access Panels: Provide wall and ceiling access panels for unrestricted access to all concealed communication equipment items and devices installed behind furrings, chases or non-removable suspended ceilings. Access Panel materials and installation requirements are specified in Division 08 Section "Access Doors and Frames."

K. Installation Inspections and Certifications

1. Obtain timely inspections of the installation by Authorities Having Jurisdiction. Remedy any deficiencies to the satisfaction of the inspecting official.

2. Upon final completion of the Work, obtain certificates of acceptance from the Authorities Having Jurisdiction. Deliver the certificates to the Owner.

3.5 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when raceways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves where cable or conduit penetrations occur. Install sleeves during erection of slabs and walls.

1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Exception: Slab-on-grade construction shall not require sleeves or curbed formed openings when conduits or pipes that penetrate the slab-on-grade are installed and properly supported prior to the pouring of the slab.

C. Masonry Walls: Install sleeves where cable or conduit penetrations occur. Install sleeves during erection of walls.

1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

F. Non Fire-Rated Assemblies: Install sleeves where cable penetrations occur. Install sleeves during erection of walls.

1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

G. Cut sleeves to length for mounting flush with both surfaces of walls.

H. Extend sleeves installed in floors a minimum of 2 inches (50 mm) above finished floor level.

I. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless otherwise indicated or unless seismic criteria requires different clearance.

J. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
2. Apply approved joint compound for gypsum board assemblies where masonry or concrete wall is faced on interior side with gypsum board.

K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

M. Roof-Penetration Sleeves: Seal penetration of individual conduits and cables with flashing units applied in coordination with roofing work. Provide flashing unit as specified in Division 07 Section "Sheet Metal Flashing and Trim".

N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

O. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.6 OPTION TO RELOCATE DEVICES

A. The location of data and telephone outlets and other similar devices along with their associated connections may be relocated at the Owner's option, at no additional cost to the Owner, to a point within 10 feet of their present location provided the Contractor is notified prior to rough-in or installation.

3.7 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.8 UTILITIES

A. The location of telecommunications lines included within the Work are indicated in the Contract Documents in accordance with information furnished by the Owner. Existing utility lines not indicated in Contract Documents but encountered during construction shall be protected, relocated or capped as directed by the Owner.

B. Prior to excavation, examine the site and verify the location and elevation of all utilities and their relation to the Work. Identify and label all underground utilities occurring within the bounds of the area to be excavated. Contact the known utilities and engage a certified locator service to assist in this effort.

C. Prior to excavation, contact the known utilities and inform them of excavation work plan. Proceed with excavation only after receiving approval from Utilities.

**D.** [**Assist the Owner in arranging for the removal of existing utility lines within the scope of this Project that are labeled to be abandoned or removed with the respective Utility.**]

E. All precautions shall be exercised to prevent damage to existing lines, but should work become necessary, it must be authorized prior to execution except in an emergency situation.

F. Should damage result to any utility through the Contractor's negligence or failure to comply with the above directives, the Contractor shall bear the sole responsibility to correct such damage and shall be responsible for all expenses incurred in the expeditious repair or replacement of such damaged Utilities.

G. Repair of damaged utilities shall be to a condition equal to or better than the adjacent undamaged portion of such utility and to the complete satisfaction of the Owner and respective Utility.

H. Owner Furnished Equipment: Telecommunications wiring required for Owner Furnished Equipment may not be shown on the Drawings. This wiring shall be provided. Coordinated connection requirements and locations with Owner.

1. Request all rough-in documentation required for proper installation of the telecommunications work in ample time to permit preparation of the installation drawings.

3.9 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communication installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

B. Apply putty pads to boxes located in fire-rated wall assemblies in which a horizontal distance of greater than 24" between boxes is not maintained. Putty pad materials and installation requirements are specified in Division 09 Section "Gypsum Board Assemblies."

3.10 SEALANT

A. Apply sealant to penetrations of all floor and wall assemblies to maintain pressure differentials required by AIA for all pressure sensitive rooms including: Isolation rooms, Pharmacy including Chemo Prep, Sterile Prep and Ante rooms. Sealant materials and installation requirements are specified in Division 07 Section "Joint Sealants" and Division 09 Section "Gypsum Board Assemblies.

3.11 FIELD QUALITY CONTROL.

A. Conduct tests as part of the Work of this Division. Include the services of qualified personnel as well as all equipment, apparatus, and services required.

B. Prior to execution of testing, notify Architect of proposed test procedures and forms.

C. Testing requirements are listed under individual sections of this Division.

END OF SECTION

[APPENDIX

UNIT PRICING BID FORM

Vendor **EXAMPLE ONLY**
Contact _____
Telephone _____ Fax # _____ Email _____
Cabling System Proposed

| HORIZONTAL CABLING | | | |
|---|---|---|---|
| COMPONENT | QUANTITY | UNIT PRICE | TOTAL PRICE |
| Cable – CAT 6 PVC White 24566315 | | | |
| Cable – CAT 6 PVC Black 24566415 | | | |
| Cable – 25 Pair CAT 5e 24576123 | | | |
| RJ-45 CAT 6 Jack – Almond AX101064 | | | |
| RJ-45 CAT 6 Jack – Black AX101066 | | | |
| Surface Mount Outlet – AO645272 | | | |
| Face Plate – Almond – AX101436 | | | |
| Stainless Wall Plate– AX102006 | | | |
| Patch Panels – CAT 6 48 port AX101613 | | | |
| Patch Panels – CAT 6 24 port AX101611 | | | |
| Patch Panels – CAT 5E 48 port AX100454 | | | |
| Patch Panels – CAT 5E 24 port AX100452 | | | |
| 110type hardware – 300 Pr. equipped with C4 connectors AX100695 | | | |
| 110type hardware – 100 Pr. equipped with C4 connectors AX100693 | | | |
| Voice Block Wire Management AX100706 | | | |
| Equipment Rack – 84" – BHRR194 | | | |
| 4 – Post Equipment Rack – BSR-8419-28 | | | |
| Horizontal Wire Management – BHH192U | | | |
| Vertical Wire Management 3" – BHVHH03 | | | |
| Vertical Wire Management 3" – BHVHH06 | | | |
| Cable Runway (Ladder Rack) 18" SB-17-18-FB | | | |
| Installation of Owner Provided AP | | | |
| | | | |
| Misc Materials | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| Material Total | | | $ |
| Labor Total | | | $ |
| | | | |
| HORIZONTAL CABLE TOTAL | | | $ |

| STRUCTURED CABLING BID SUMMARY | | | |
|---|---|---|---|
| | **EXAMPLE ONLY** | | |
| **COPPER RISER CABLE** | TOTAL PROJECT | | |
| | | | |
| COMPONENT | QUANTITY | UNIT PRICE | TOTAL PRICE |
| 200 Pair D-Riser Cable 24501906 | | | |
| 110-type Hardware- 300 Pre-equipped with C5 connectors AX100696 | | | |
| Minor materials | | | |
| | | | |
| Material Total | | | $ |
| Labor Total | | | $ |
| | | | |
| COPPER RISER CABLE TOTAL | | | $ |

D.

| **OPTICAL FIBER BACKBONE** | TOTAL PROJECT | | |
|---|---|---|---|
| | **EXAMPLE ONLY** | | |
| COMPONENT | QUANTITY | UNIT PRICE | TOTAL PRICE |
| 24 Strand Armored Single Mode Fiber Optic Cable M9W242 | | | |
| Inter Connect Unit - 1U AX100041 | | | |
| LC Connector Module AX101743 | | | |
| Inter Connect Unit - 4U AX100116 | | | |
| LC Connector Module AX101743 | | | |
| Optical Fiber LC Connectors AX101983 | | | |
| | | | |
| Minor materials | | | |
| | | | |
| Material Total | | | $ |
| Labor Total | | | $ |
| | | | |
| OPTICAL FIBER BACKBONE TOTAL | | | $ |
| TOTAL VOICE & DATA SYSTEM PRICE | | | |
| | | | |
| Horizontal Cabling | | | $ |
| Copper Riser Cable | | | $ |
| Optical Fiber Backbone | | | $ |
| | | | |
| TOTAL | | | $ |

E.

| **CABLE/SATELLITE DISTRIBUTION SYSTEM** | **EXAMPLE ONLY** | |
|---|---|---|

| | | | |
|---|---|---|---|
| COMPONENT | QUANTITY | UNIT PRICE | TOTAL PRICE |
| Cable – CAT 5E PVC Blue 24570161 | | | |
| RJ-45 CAT 5E Jack – Blue AX101315 | | | |
| RG6 PVC Cable 533945-BELDEN | | | |
| RG11 Cable | | | |
| Stainless Steel Faceplates AX102005 | | | |
| Patch Panels – CAT 5E 48 port AX100454 | | | |
| Patch Panels – CAT 5E 24 port AX100452 | | | |
| Horizontal Wire Management – BHH192U | | | |
| MM Fiber | | | |
| Minor materials | | | |
| Material Total | | | $ |
| Labor Total | | | $ |
| | | | |
| TELEVISION DISTRIBUTION TOTAL | | | $ |
| **PHYSIOLOGICAL/TELEMETRY MONITORING** | **EXAMPLE ONLY** | | |
| | | | |
| COMPONENT | QUANTITY | UNIT PRICE | TOTAL PRICE |
| Cable – CAT 5E PVC Orange 24596505 | | | |
| RJ-45 CAT 5E Jack – Orange AX101048 | | | |
| Patch Panels – CAT 5E 48 port AX100454 | | | |
| Patch Panels – CAT 5E 24 port AX100452 | | | |
| Surface Mount Outlet – AO645272 | | | |
| Face Plate – Almond – AX101436 | | | |
| Horizontal Wire Management – BHH192U | | | |
| MM Fiber | | | |
| Minor materials | | | |
| Material Total | | | $ |
| Labor Total | | | $ |
| | | | |
| MONITORING TOTAL | | | $ |

F.

| | | | |
|---|---|---|---|
| **NURSE CALL/OVERHEAD PAGING CABLE ROUGH-IN** | **EXAMPLE ONLY** | | |
| | | | |
| COMPONENT | QUANTITY | UNIT PRICE | TOTAL PRICE |
| Misc. Cable | | | |
| Minor materials | | | |
| | | | |
| Material Total | | | $ |
| Labor Total | | | $ |
| | | | |
| NURSE CALL/OVERHEAD PAGING ROUGH-IN TOTAL | | | $ |

G.

| | | | |
|---|---|---|---|
| **SNAKE TRAY & J-Hooks** | **EXAMPLE ONLY** | | |
| | | | |
| COMPONENT | QUANTITY | UNIT PRICE | TOTAL PRICE |

| | | | |
|---|---|---|---|
| CM501-5-8 (5" X 5" X 8' Tray) | | | |
| CB-10 (Universal Connector) | | | |
| J-Hooks | | | |
| Mounting Hardware | | | |
| Material Total | | | $ |
| **FIRE RATED SLEEVES** | **EXAMPLE ONLY** | | |
| | | | |
| COMPONENT | QUANTITY | UNIT PRICE | TOTAL PRICE |
| 3" OR 4" Sleeves Hilti Speed Sleeve 236324 | | | |
| 1" OR 2" Sleeves Hilti Speed Sleeve 236323 | | | |
| | | | |
| Material Total | | | $ |
| Labor Total | | | $ |
| | | | |
| FIRE RATED SLEEVES TOTAL | | | $ |
| Labor Total | | | $ |
| | | | |
| SNAKE TRAY TOTAL | | | $ |

| ADD & DELETE UNIT PRICES | | |
|---|---|---|
| COMPONENT | ON SITE DURING CONSTRUCTION | RETURN TRIP REQUIRED AFTER CONSTRUCTION |
| Wall Telephone Outlet | $ | $ |
| One Jack Outlet | $ | $ |
| Two Jack Outlet | $ | $ |
| Three Jack Outlet | $ | $ |
| Four Jack Outlet | $ | $ |
| | | |

| HOURLY LABOR RATES | | |
|---|---|---|
| COMPONENT | ON SITE DURING CONSTRUCTION | RETURN TRIP REQUIRED AFTER CONSTRUCTION |
| Regular Time/HR | $ | $ |
| Overtime/HR | $ | $ |
| Holiday Time/HR | $ | $ |
| | | |

END OF APPENDIX]

# SECTION 270526

# GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. NFPA 70 and IEEE C2 include basic grounding requirements for electrical safety. This Section supplements the minimum safety requirements of the Code with requirements for additional grounding and with optional grounding methods and materials for both power and electronic systems.

B. This Section includes:

1. Grounding conductors.
2. Grounding connectors.
3. Grounding busbars.
4. Grounding labeling.

### 1.2 DEFINITIONS

A. BCT: Bonding conductor for telecommunications.

B. EMT: Electrical metallic tubing.

C. TGB: Telecommunications grounding busbar.

D. TMGB: Telecommunications main grounding busbar.

### 1.3 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 27 Section "Common Work Results for Communications" for products specified under PART 2 - PRODUCTS.

B. Product Data: For each type of product indicated.

### 1.4 INFORMATIONAL SUBMITTALS

A. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding and bonding infrastructure, including the following:

1. Ground rods.
2. Ground and roof rings.
3. BCT, TMGB, TGBs, and routing of their bonding conductors.

B. Qualification Data: For Installer, installation supervisor, and field inspector.

C. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:

1. Manufacturer's routine maintenance requirements for cables, terminations and all installed components.
2. Result of the ground-resistance test, measured at the point of BCT connection.
3. Result of the bonding-resistance test at each TGB and its nearest grounding electrode.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: For cabling installer with personnel certified by BICSI on staff as defined in Division **27** Section "Common Work Results for Communications".

B. Comply with NFPA 70.

C. Comply with NFPA 99.

D. Comply with IEEE C2.

E. Comply with ANSI-J-STD-607-A.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

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

1. Harger Lightning and Grounding.
2. Panduit Corp.
3. Tyco Electronics Corp.

B. Comply with UL 486A-486B.

C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.

1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.

2. Cable Tray Equipment Grounding Wire: No. 8 AWG.

D. Cable Tray Grounding Jumper:

1. Not smaller than No. 6 AWG and not longer than 12 inches (300 mm). If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. If jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.
2. Not smaller than No. 10 AWG and not longer than 12 inches (300 mm). If jumper is a wire, it shall have a crimped grounding lug with one hole and standard barrel for one crimp. If jumper is a flexible braid, it shall have a one- or two-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.

E.

F. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.

3. Bonding Cable: 28 kcmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, 1/4 inch (6.3 mm) in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors, terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS

A. Irreversible connectors listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

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

1. Burndy; Part of Hubbell Electrical Systems.
2. Chatsworth Products, Inc.
3. Harger Lightning and Grounding.
4. Panduit Corp.
5. Tyco Electronics Corp.

C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

D. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.

E. Busbar Connectors: Cast silicon bronze, solderless exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.

F. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING BUSBARS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chatsworth Products, Inc.
2. Harger Lightning and Grounding.
3. Panduit Corp.

B. TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, 20 inches (500 mm) in length. The busbar shall be NRTL listed for use as TMGB and shall comply with J-STD-607-A.

1. Predrilling shall be with holes for use with lugs specified in this Section.

2. Mounting Hardware: Stand-off brackets that provide a 4-inch (100-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

C. TGB: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 2 inches (6.3 by 50 mm) in cross section, 10 inches (250 mm) in length. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-A.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch (50-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V

2.5 LABELING

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

1. Brother International Corporation.
2. HellermannTyton
3. Panduit Corp.

B. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.

B. Inspect the test results of the ac grounding system measured at the point of BCT connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

B. Comply with NECA 1.

C. Comply with J-STD-607-A.

3.3 APPLICATION

A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.

B. Underground Grounding Conductors: Install barecopper conductor, No. 3/0 AWG minimum.

1. Bury at least 30 inches (762 mm) below grade.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

D. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches (900 mm).

E. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch (900-mm) intervals.
4. Install grounding and bonding conductors in 3/4-inch (21-mm) PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.

    a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 260533 "Raceways and Boxes for Electrical Systems," and bond both ends of the conduit to a TGB.

3.4 GROUNDING ELECTRODE SYSTEM

A. The BCT between the TMGB and the ac service equipment ground shall not be smaller than No. 1/0 AWG.

3.5 GROUNDING BUSBARS

A. Grounding Bus: Install in telecommunications equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install busbars horizontally, on insulated spacers 2 inch (50 mm) minimum from wall, 12 inches (300 mm) above finished floor, unless otherwise indicated.

3.6 CONNECTIONS

A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.

B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.
2. Pretwist the conductor.
3. Apply an antioxidant compound to all bolted and compression connections.

D. Primary Protector: Bond to the TMGB with insulated bonding conductor.

E. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot (1 sq. mm/linear meter) of conductor length, up to a maximum size of No. 3/0 AWG 168 kcmils (85 sq. mm) unless otherwise indicated.

F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install top-mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.

G. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.

H. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each TGB to the ground bar of the panelboard.

I. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.

J. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

K. Access Floors: Bond all metal parts of access floors to the TGB.

## 3.7 EQUIPMENT GROUNDING

A. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

## 3.8 IDENTIFICATION

A. Labels shall be preprinted or computer-printed type.

1. Label TMGB(s) with "fs-TMGB," where "fs" is the telecommunications space identifier for the space containing the TMGB.
2. Label TGB(s) with "fs-TGB," where "fs" is the telecommunications space identifier for the space containing the TGB.
3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

## 3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 27 Section "Common Work Results for Commuinications" to perform the following field tests and inspections and prepare certified test reports:

B. Perform the following field tests and inspections and prepare test reports:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.

    a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.

3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.

    a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB. Maximum acceptable ac current level is 1 A.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.

F. Correct Deficiencies, Retest and Report:

1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace conductors, units, and rods as required to bring system into compliance.
2. Prepare a written report to record the following:

    a. Procedures used.
    b. Results that comply with requirements, identifying components checked.
    c. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
    d. Observations and test results after remedial action.

END OF SECTION

G.

# SECTION 28 05 00

# COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

## PART 1 - GENERAL

### 1.1 SUMMARY

A. The requirements contained in this Section apply to all Section of this Division.

B. Section Includes:

1. Common terminology and requirements used throughout this Division.
2. Requirements for Manufacturer Seismic Certification.
3. Requirements for Manufacturer Special Seismic Certification.
4. Electronic safety and security equipment coordination and installation.
5. Sleeves for raceways and cables.
6. Sleeve seals.
7. Grout.
8. Common electronic safety and security installation requirements.

### 1.2 DEFINITIONS

A. AHJ: Authorities Having Jurisdiction.

B. Bound Material: Bound refers to materials permanently bound, as by stitching or glue, or materials securely fastened in their covers by multiple fasteners that penetrate all papers. Ring binders, spiral binders, brads and screw posts are acceptable fasteners. Loose papers clipped together or stapled at one corner are not acceptable.

C. Business Day: Where this Section and other Sections of this Division use the term "Business Day" it shall mean Monday thru Friday, excluding Holidays recognized by Federal, State and Local government.

D. EPDM: Ethylene-propylene-diene terpolymer rubber.

E. FMS: Facility management system.

F. NBR: Acrylonitrile-butadiene rubber.

G. Seismic Certification: Seismic certification refers to a manufacturer's certification for architectural, mechanical, and electrical components, supports, and attachments pursuant to ASCE/SEI 7-05 Section 13 .2 .1.2.

H. Seismic Qualification: Same as Special Seismic Certification

I. Special Seismic Certification: Seismic certification of mechanical and electrical equipment based on ASCE/SEI 7-05 Section 13 .2 .2. Special Seismic Certification is required for active mechanical and electrical equipment that must remain operable following the design earthquake.

1.3 PERFORMANCE REQUIREMENTS

A. The Drawings diagrammatically show the sizes and locations of various equipment and devices, and the sizes of the major interconnecting wires, without showing exact details as to elevations, offsets, wiring and other installation requirements. Carefully layout the Work at the site to conform to the architectural and structural conditions, to avoid obstructions and to permit proper grading of pipe associated with other portions of the Work. In cooperation with other trades, determine the exact location of equipment and devices and connections thereto by reference to the submittals and rough-in drawings, and by measurements at the site. Make minor relocations necessitated by the conditions at the site, or directed by the Owner, without additional cost to the Owner.

1.4 ACTION SUBMITTALS

A. Common Requirements for Product Data: Where this Section and other Sections of this Division require Product Data to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Submit hardcopy of Product Data in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of product data submittals shall be bound materials as defined above. Separate products under distinct subheadings that correspond to paragraphs in specification text. Divide sections in binder with labeled divider tabs.
2. In addition to hardcopies required by Division 01, submit one copy of product data in electronic format. All files shall be in Portable Document Format (.pdf).
3. Product Data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.

B. Product Data: Submit product data for each of the following.

1. Sleeves.
2. Sleeve seals.
3. Grout.

C. Common Requirements for Shop Drawings: Where this Section and other Sections of this Division require Shop Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:

1. Prepare Shop Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®.
2. Submit hardcopy of Shop Drawings in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of Shop Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format. Files shall include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
4. Shop Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.

1.5 INFORMATIONAL SUBMITTALS

A. Common Requirements for Coordination Drawings: Where this Section and other Sections of this Division require Coordination Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" and Division 01 Section "Project Management and Coordination". In addition to the requirements of Division 01 comply with the following:

1. Prepare Coordination Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®. Drawings files must be composite with multiple distinctive layers for each of the various trades.
2. Submit hardcopy of Coordination Drawings in the quantity as required under Division 01. Hardcopies of Coordination Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format. Files shall include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
4. Coordination Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.

B. Coordination Drawings: Floor plans showing dimensioned layout for the following:

1. Penetration and Structural Opening: Floor plans showing sleeves and formed structural penetrations. Show sleeve and formed penetration layouts and relationships between structural components and other adjacent building elements, including but not limited to pre-tensioning and post-tensioning members where used.
2. Reflected Ceiling Plans: ceiling plans, sections, and other necessary details showing dimensioned layouts for equipment located in or on the ceiling plane. Base dimensions on exact dimensioned data obtained from product submittals for products to be included in the Work. Differentiate between field measurements and assumed dimensions. Include the following items coordinated with each other, based on input from installers of the items involved:

   a. Suspended ceiling components.
   b. Structural members to which suspension systems for luminaires will be attached.
   c. Perimeter moldings, decorative ceiling elements, and Architectural features.
   d. Luminaires.
   e. HVAC Diffusers, Registers and Grilles.
   f. Speakers.
   g. Sprinklers.
   h. Fire Alarm initiating devices, including but not limited to the following:

      1) Smoke detectors.
      2) Heat detectors.
      3) Flame detectors.

   i. Fire Alarm notification appliances.
   j. Occupancy sensors.
   k. Access panels.
   l. Security cameras and occupancy detectors.
   m. Wireless Access Points.
   n. Nurse Call Zone and Dome Lights.
   o. Patient Telemetry Receivers and Equipment.

3. Equipment Layouts: Floor plans, elevations, and other necessary details showing dimensioned layouts for spaces containing safety and security equipment. Base equipment dimensions on exact dimensioned data obtained from product submittals for products to be included in the Work. Differentiate between field measurements and assumed dimensions. Include the following items coordinated with each other, based on input from installers of the items involved:

    a. Equipment layout and relationships between components and adjacent structural and mechanical elements.
    b. Indication of required working clearances and required area above and around electrical equipment where pipes and ducts are prohibited.
    c. Location of Conduit entry into equipment.
    d. Location of luminaires, sprinkler piping and heads, ducts, and diffusers.
    e. Equipment support locations, type of support, and weight on each support.
    f. Location of structural supports for structure-supported raceways.
    g. For floor mounted equipment: concrete base dimension, outline of equipment, and required clearances.
    h. Location of structural supports for seismic bracing.
    i.

C. Common Requirements For Qualification Data:

1. Professional Engineer Qualifications: Where this Section and other Sections of this Division require a Professional Engineer to be responsible for Delegated Design requirements; Submit Qualification data for Professional Engineer including, but not limited to, proof of registration in the Project location.
2. Manufacturer Seismic Qualification Certification: Where this Section and other Sections of this Division require products to meet seismic requirements; Submit certification that equipment, devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems" Include the following:

    a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

        1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

    b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
    c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

3. Manufacturer Special Seismic Certification: Where this Section and other Sections of this Division require products to meet seismic requirements; Submit certification that equipment, devices, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" Include the following:

    a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Common Requirements for Material Quality: Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall be replaced with new materials, equipment or devices identical with those damaged, unless approved otherwise by the Owner in writing.

B. Common Requirements for Code Compliance: In case where differences occur between building codes, state laws, local ordinances, industry standards, and the Contract Documents, the most stringent shall govern. Perform the following:

1. Promptly notify the Architect in writing of any such difference.
2. Obtain approval from Architect before proceeding with the Work.
3. Should the Contractor perform any work that knowingly does not comply with local codes, laws and ordinances, industry standards, or other governing regulations; the Work shall be corrected at no cost to the Owner.

C. Common Requirements for Compliance with AHJ Instructions: In cases where the Authority Having Jurisdiction requires deviations from the requirements of the Contract Documents, perform the following:

1. Promptly notify the Architect in writing of any such difference.
2. Obtain approval from Architect before proceeding with the Work.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided shall meet the requirements of the UL standard.

1.7 PRODUCT SUBSTITUTIONS

A. Comply with provisions of Division 01 Section "Product Requirements".

1. If item of equipment or device offered as Substitution differs in dimension or configuration from that indicated in the Contract Documents, provide, as part of the substitution submittal, a drawing that shows that the equipment or devices proposed for Substitution can be installed in the space available without interfering with other trades or with access requirements for operations and maintenance in the completed project. Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.

2. Where substitute equipment or devices requires different arrangement or connections from that indicated in the Contract Documents, install the equipment or devices to operate properly and in accordance with the requirements of the Contract Documents. Make incidental changes necessary in piping, ductwork or wiring which results from the inclusion of the substitute equipment or device without any additional cost to the Owner. Pay all additional costs incurred by other trades in connection with changes required by the inclusion of the substituted equipment or device in the Work.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm and Security Service: Do not interrupt fire-alarm or security service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fire alarm service or fire watch according to requirements of local fire marshal:

1. Notify Construction Manager and Owner no fewer than five business days in advance of proposed interruption of Fire-Alarm or Security service.
2. Do not proceed with interruption of Fire-Alarm or Security service without Construction Manager's and Owner's written permission.

B. Schedule of Work in Existing Facilities:

1. The building will continue in use throughout the construction period, carry out the Work in such a manner as to minimize disturbance to the occupants.
2. The schedule contemplates working in designated areas in the existing building while other adjacent areas are still being occupied. Carry out the Work in such a manner as to minimize disturbance to those occupied areas.
3. Should the Work in the designated areas affect any services to the areas that are to remain in use, new permanent or temporary services or a combination of both shall be installed as required to enable those occupied areas to function properly and without interruption.
4. Perform no work in the existing building which would interfere with its use during normal hours of occupancy, Including but not limited to operations which would cause objectionable noise or service interruptions, unless special permission is granted by the Owner.

1.9 COORDINATION

A. In describing various materials, equipment and devices, in general each item may be described singularly, even though there may be a multiplicity of identical items. Also, where the description is general in nature, the exact sizes, duties, space arrangements, and other requirements must be obtained by reference to other portions of Contract Documents.

B. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer. Verify that all materials, equipment and devices proposed for use on this Project are within the constraints of the allocated space.

C. Coordinate arrangement, mounting, and support of electronic safety and security equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.

4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

D. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

E. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

F. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".

## PART 2 - PRODUCTS

### 2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

### 2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

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

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 EXAMINATION

**A.** The Drawings do not indicate existing installations other than to identify modifications or extensions thereto. Visit the site and ascertain the existing conditions. Review construction details of the existing portion of the building during the site inspection. Include all Work required to remove or modify portions of the existing installation in order to accommodate the new Work. Failure to comply with this will not be considered grounds for additional payment in connection with removing or modifying any part of the existing installation or installing any new or temporary Work.

3.2 TEMPORARY WORKING ACCESS

A. Remove existing wire, conduit, equipment, fixtures, and other items as required to provide access for Work in existing facilities.

B. Clean and Reinstall items removed to match existing adjacent conditions upon completion of the Work.

C. Replace items damaged during removal to match existing adjacent conditions upon completion of the Work.

3.3 SALVAGE, DEMOLITION AND RELOCATION

A. Modify, remove, salvage, or relocate materials, equipment and devices as indicated or required by the installation of new Work.

B. Salvage and Demolition: Working jointly with the Owner's Representative, establish and mark salvage and demolition items before commencing work; report items scheduled for relocation, reinstallation or reuse, which are found to be in damaged condition; await further instructions from the Owner before commencing Work.

1. Demolition material shall be removed from the site and disposed of in a legal manner.
2. Salvaged equipment and devices shall be the property of the Owner, unless otherwise indicated. Store salvaged items in locations as directed by Owner.

C. Relocations: Make minor relocations necessitated by the conditions at the site or as directed by the Owner's Representative, without additional cost to the Owner.

1. Remove items which are to be relocated in reverse order to original assembly or placement.
2. Protect items until relocation is complete.
3. Clean, Repair and restore to good functional condition, equipment, materials and items scheduled for relocation. Provide new fittings and appurtenances required to complete the relocations and to restore to good operating order.

D. Substitution of New materials for Relocation: New materials of similar design and quality may be substituted for materials and items indicated to be relocated upon approval of Owner and Architect. Comply with Division 01 for Substitution Procedures.

3.4 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

A. Comply with NECA 1 - Standard Practices for Good Workmanship in Electrical Construction, as published by the National Electrical Contractors Association.

B. Comply with NECA 305 - Standard for Fire Alarm System Job Practices, as published by the National Electrical Contractors Association.

C. Comply with NFPA 731 - Standard for the Installation of Electronic Premises Security Systems.

D. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items, unless otherwise indicated.

E. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

F. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a manner as to facilitate future disconnecting with minimum interference with other items in the vicinity.

G. Right of Way: Give to piping systems installed at a required slope.

H. Access Panels: Provide wall and ceiling access panels for unrestricted access to all concealed fire-alarm and security equipment items and devices installed behind furrings, chases or non-removable suspended ceilings. Access Panel materials and installation requirements are specified in Division 08 Section "Access Doors and Frames."

I. Installation Inspections and Certifications

1. Obtain timely inspections of the installation by Authorities Having Jurisdiction. Remedy any deficiencies to the satisfaction of the inspecting official.
2. Upon final completion of the Work, obtain certificates of acceptance from the Authorities Having Jurisdiction. Deliver the certificates to the Owner.

3.5 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

A. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves where cable or conduit penetrations occur. Install sleeves during erection of slabs and walls.

1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Exception: Slab-on-grade construction shall not require sleeves or curbed formed openings when conduits or pipes that penetrate the slab-on-grade are installed and properly supported prior to the pouring of the slab.

C. Masonry Walls: Install sleeves where cable or conduit penetrations occur. Install sleeves during erection of walls.

1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

F. Non Fire-Rated Assemblies: Install sleeves where cable penetrations occur. Install sleeves during erection of walls.

1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

G. Cut sleeves to length for mounting flush with both surfaces of walls.

H. Extend sleeves installed in floors a minimum of 2 inches above finished floor level.

I. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless otherwise indicated or unless seismic criteria requires different clearance.

J. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
2. Apply approved joint compound for gypsum board assemblies where masonry or concrete wall is faced on interior side with gypsum board.

K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

M. Roof-Penetration Sleeves: Seal penetration of individual conduits and cables with flashing units applied in coordination with roofing work. Provide flashing unit as specified in Division 07 Section "Sheet Metal Flashing and Trim".

N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

O. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 SEALANT

A. Apply sealant to penetrations of all floor and wall assemblies to maintain pressure differentials required by AIA for all pressure sensitive rooms including: Isolation rooms. Sealant materials and installation requirements are specified in Division 07 Section "Joint Sealants" and Division 09 Section "Gypsum Board Assemblies.

3.8 FIELD QUALITY CONTROL

A. Conduct tests as part of the Work of this Division. Include the services of qualified personnel as well as all equipment, apparatus, and services required.

B. Conduct tests under conditions free from short circuits and from grounds.

C. Prior to execution of testing, notify Architect of proposed test procedures and forms.

D. Testing requirements are listed under individual sections of this Division. Sections requiring testing include, but are not limited to the following:

1. NFPA 72 acceptance tests and startup for fire alarm system, in accordance with Division 28 Section "Fire Detection and Alarm."

3.9 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

B. Apply putty pads to boxes located in fire-rated wall assemblies in which a horizontal distance of greater than 24" between boxes is not maintained. Putty pad materials and installation requirements are specified in Division 09 Section "Gypsum Board Assemblies."

END OF SECTION

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# PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section Includes:

1. Delegated Design requirements for system design.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Notification appliances.
5. Magnetic door holders.
6. Addressable interface devices.
7. Digital alarm communicator transmitter.

## 1.2 DEFINITIONS

A. Definitions in NFPA 72 apply to fire alarm terms used in this Section

B. CPVC: Chlorinated Poly Vinyl Chloride

C. EPO: Emergency Power Off System.

D. FAAP: Fire Alarm Annunciator Panel (Remote Annunciator).

E. FACP: Fire Alarm Control Unit (Panel).

F. FSCS: Firefighters' Smoke Control Station (panel).

G. IDC: Initiating Device Circuit

H. LED: Light-emitting diode

I. NAC: Notification appliance circuit.

J. NICET: National Institute for Certification in Engineering Technologies.

K. NRTL: Nationally Recognized Testing Laboratory

L. OSHPD: Office of Statewide Health Planning and Development for the State of California.

M. SLC: Signaling Line Circuit

## 1.3 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only. The system shall detect fire conditions, alarm the building occupants of a fire condition, control the necessary systems to suppress fire and smoke and shall summon the local Fire Department automatically without the need for human intervention/human action.

B. The fire alarm system shall be a microprocessor based network system.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: These specifications and the accompanying Drawings define the intent of the fire alarm system to be provided. In addition to the system as specified herein and shown on the Drawings, provide all planning, design, calculations, equipment, devices, raceways, boxes, cabling, system programming and any other component or service required for a complete, fully operational and code compliant system.

1. Premises protection includes Construction Type 1-A and Occupancy I-2.

B. System Zoning: Fire-alarm control system and all associated circuits shall be arranged to comply with zoning requirements of NFPA 72 and the following:

1. Each smoke compartment is an evacuation signaling zone for this Project.
2. Display each intelligent addressable device at the main fire alarm control panel in accordance with the following:

a. Use a unique alphanumeric label identifying each device location.
b. Include a descriptive reference with alphanumeric label that corresponds to devices' specific location and zone.
c. Comply with the Owner's labeling methodology requirements. Present proposed labeling methodology to Owner and Engineer prior to implementation.

C. Voltage Drop Calculations: Design system for a maximum of 10 percent voltage drop for each notification appliance circuit.

1.5 ACTION SUBMITTALS

A. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 26 Section "Common Work Results for Electrical".

B. Submit product data and shop drawings in accordance with Division 01 and Division 28 Section "Common Work Results for Electronic Safety and Security" for products specified under PART 2 - PRODUCTS.

C. General Submittal Requirements:

1. Submittals shall be approved by Architect prior to submitting them to authorities having jurisdiction.
2. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.

D. Simultaneous Action Submittals: Product Data, Delegated-Design Submittal, and Delegated-Design Shop Drawings submittal shall be submitted simultaneously.

E. Product Data: For each type of product indicated, include the following:

1. Supervisory power usage.
2. Alarm power usage.
3. Physical dimensions of equipment.
4. Finish.
5. Mounting requirements.
6. Performance parameters and installation details for each type of detector.

7. Performance parameters for duct-mounted detectors verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.

F. Delegated-Design Submittal: For fire-alarm system. Signed and sealed by the qualified professional responsible for their preparation. Include the following:

1. Circuit loading and voltage drop calculations for each circuit. Include voltage drop calculations for notification appliance circuits.
2. Battery-size calculations in a spreadsheet type format with a complete listing of all devices, quantities, individual component supervisory current and alarm current. Indicate the total supervisory and alarm currents, hours of backup, minutes in alarm and total battery amp-hour rating.
3. Calculations for selecting the spacing and sensitivity of detection devices.

   a. Include calculations for area and duct-mounted detectors.

   b. Mathematical justification for audible notification device placement to meet code required sound dB levels.

4.
5. Complete sequence of operation of the fire alarm system.
6. System Input-Output Matrix.

G. Delegated-Design Shop Drawings: For fire-alarm system. Signed and sealed by the qualified professional responsible for their preparation. Include the following:

1. Plans, elevations, sections, details, and attachments to other work. Include floor plans to indicate final outlet locations showing address of each addressable device.

   a. Prepare shop drawings using symbols and notes as recommended in NFPA 170 "Standard for Fire Safety and Emergency Symbols."
   b. Include location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.

   c. Include location of each audible notification device, ratings of each, and installation details as needed to comply with NFPA 72 sound dB level requirement. Annotate to correspond with mathematical calculations.
   d. Include location of each visible notification device, ratings of each, and installation details as needed to comply with NFPA 72. Annotate coverage patterns to show placement meets coverage requirements of NFPA 72.
   e. Show size and route of cable and conduits.

2. One-line riser drawing for the entire system network indicating panel-to-panel conductors including type, size, quantity and specific function.
3. System address and labeling methodology
4. System wiring diagrams indicating interfaces to equipment supplied by others.
5. Device "typical" wiring diagrams. These drawings shall indicate specific termination details for all peripheral equipment and/or interface devices.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit Coordination Drawings in accordance with Division 26 Section "Common Work Results for Electronic Safety and Security". Include the following:

1. Enlarged Equipment Room layouts.
2. Reflected Ceiling Plans.
3. Heating, ventilating, and air-conditioning duct drawings, 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.

B. Qualification Data: For qualified Designer and Installer.

1. Copy of State license showing the fire alarm contractor to be certified in the layout and installation of fire alarm systems.
2. Copy of NICET certification showing the fire alarm contractor to be certified in the layout, equipment selection, installation, acceptance testing, trouble-shooting, servicing and sales of fire alarm systems.

C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. 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 01 Section "Operation and Maintenance Data," 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 "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems".

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.

1.8 QUALITY ASSURANCE

A. Designer Qualifications: Shop Drawings shall be prepared and signed by personnel with the following qualifications:

1. Trained and certified by manufacturer.

2. Certified by NICET as Level IV or a qualified professional engineer.
3. Licensed by authorities having jurisdiction.

B. Installer Qualifications: Personnel shall be trained and certified by manufacturer and be certified by NICET as follows:

1. Supervisor: Level III or higher.
2. Technician: Level II or higher.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

F. Comply with NFPA 70

G. Comply with NFPA 72

H. Comply with the Americans with Disabilities Act (ADA); including local amendments, modifications and additional accessibility requirements of the authorities having jurisdiction.

I. Comply with International Standards Organization (ISO)

1. ISO-9000
2. ISO-9001

1.9 DELIVERY, STORAGE, AND HANDLING

A. Prepare products for shipment.

1. Provide suitable packaging materials, crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
2. Weatherproof packaging for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.

B. Store products indoors in clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Protect products from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. Handle product components according to manufacturer's written instructions.

1.10 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Comply with requirements defined in Division 28 Section "Common Work Results for Safety and Security".

1.11 COORDINATION

A. Coordinate installation and operational requirements for automatic elevator recall, including but not limited to the recall signal time frame, with Division 14 and with authorities having jurisdiction.

B. Coordinate installation and operational requirements for fire-protection systems, including but not limited to water-based sprinkler system, with Division 21.

C. Coordinate installation and operational requirements for duct mounted smoke detectors with Division 21 and 23.

1.12 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.13 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. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.14 MAINTENANCE AGREEMENT

A. Initial Maintenance Service: Beginning at Substantial Completion, provide full inspection and maintenance by skilled employees of manufacturer's designated service organization during the Warranty period, including any special warranty period specified.

1. Include inspection, maintenance, testing, and repair contract in compliance with the manufacturer's recommended routine preventive maintenance program and NFPA 72 requirements necessary to maintain full ongoing listing on the complete installed system.
2. Provide parts and supplies same as those used in the manufacture and installation of the original equipment.
3. The contractor performing the contract services shall be qualified and listed to maintain ongoing certification and listing of the completed system.

B. Extended Maintenance Service: Offer for the Owner's consideration and evaluation at the time of Product Data Submittal, a priced inspection, maintenance, testing, and repair contract in compliance with the manufacturer's recommended routine preventive maintenance program and NFPA 72 requirements necessary to maintain full ongoing listing on the complete installed system.

1. The services offered under this contract shall begin after the completion of the Initial Maintenance Service and Warranty Period.
2. The Owner shall have the option of renewing for single or multiple years, up to five years, at the price quoted upon completion of the Warranty period.
3. The contractor performing the contract services shall be qualified and listed to maintain ongoing certification and listing of the completed system.

1.15 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Lamps for Strobe Units: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Smoke Detectors and Heat Detectors: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
4. Detector Bases: 2 for every 100 of each type installed. Furnish at least one of each type.
5. Keys and Tools: One extra set for access to locked and tamper-proofed components.
6. Audible and Visible Notification Appliances: 1 for every 100 of each type installed. Furnish at least one of each type.
7. Fuses: Three of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Match Existing.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Alarm signals:

1. Fire-alarm signal initiation (General Alarm) shall be by one or more of the following devices and systems:

a. Manual Fire-Alarm Boxes.
b. Heat detectors.
c. Smoke detectors.
d. Duct-Mounted smoke detectors.
e. Automatic sprinkler system water flow.
**f.** Fire-extinguishing system operation

2. Supervisory signal initiation (Supervisory Alarm) shall be by one or more of the following devices and actions:

   a. Valve supervisory switch. (Operation of a fire-protection system valve tamper switch.)

3. System trouble signal initiation (Trouble Alarm) shall be by one or more of the following devices and actions:

   a. Open circuits, shorts, and grounds in designated circuits.
   b. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
   c. Loss of primary power at fire-alarm control unit.
   d. Ground or a single break in fire-alarm control unit internal circuits.
   e. Abnormal ac voltage at fire-alarm control unit.
   f. Break in standby battery circuitry.
   g. Failure of battery charging.
   h. Abnormal position of any switch at fire-alarm control unit or annunciator.

B. Alarm Actions:

1. Fire alarm signal (General Alarm) shall initiate the following actions:

   a. Continuously operate alarm notification appliances as indicated. Notification of a General Alarm conditions within the protected premises shall be similar to the following methodology:

      1) Notification: Comply with the NFPA 72 requirements for Relocation and Partial Evacuation. Activate audible indicating devices throughout the entire facility with specific audio messages as listed below. Activate visible indicating devices throughout the evacuation signaling zone where the alarm signal originated. Provide custom programming to modify standard audio messages to comply with the Owners' evaluation protocol. Provide separate notification circuits as required to accomplish the following audio messages and actions that shall occur simultaneously:

         a) An 'evacuation' message shall be sounded in the evacuation signaling zone where the alarm originated. The intent of this message to advise occupants hearing this message that they are near danger and should leave the zone in alarm immediately.
         b) An 'alert' message shall be sounded through out the remainder of the facility. It is the intent of this message to advise occupants that an alarm has been reported in the building and they should prepare for evacuation if necessary, but should remain in place until instructed to evacuate.
         c) Provide separate notification zone for selective manual paging for enclosed stairways. Automatic messages in stairwells are not permitted.

   b. Identify alarm at fire-alarm control unit and remote annunciators. Indication, notification and acknowledgement of alarm conditions at the fire-alarm control unit shall be similar to the following methodology:

1) When the system control panel goes into alarm condition the normal indicator light shall extinguish and an alarm indicator light shall illuminate, a control panel audible alert (buzzer) shall pulsate.
2) Visually indicate, via the system control panel LCD display, all applicable information associated with the status condition including; the real time, the number of messages waiting, the type of alarm, the alarm zone number, the device type, the device location, the time/date the alarm occurred and any user specified message(s).
3) The operator shall acknowledge the alarm/message by pressing an acknowledge button, and the buzzer shall silence providing there isn't an additional alarm pending. If there are additional alarms waiting the operator must acknowledge all pending alarms/messages before the buzzer will silence.

4) To silence audible devices and stop visible devices from flashing the operator may press the alarm silence button; a new alarm shall cause the audible and visible devices to resound/flash. The visible devices shall stop operating when the "Alarm Silence" button is pressed, failure to do so could result in confusion of hearing-impaired occupants.
5) To reset the system the operator shall press the reset button.
6) Any remote or local annunciator LCD/LED's associated with the status zone shall be illuminated.

c. Transmit an alarm signal to the remote alarm supervising station.

1) Operate alarm relay contacts to initiate the transmission of an alarm to the following:

a) A Central Monitoring Station retained by the Owner via an auto-dialer or within the system control panel.

d. Unlock electric door locks in path of egress.
e. Release fire and smoke doors held open by magnetic door holders.

1) Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

f. Activate voice/alarm communication system.

g. Record events in the system memory.
h. Comply with additional sequences specified under the "Additional Specialized Alarm Actions" paragraph in Part 2 of this section.

2. System Trouble and Supervisory Signal Actions shall initiate the following actions:

a. Notification appliance and annunciate at the FACP and remote annunciators.
b. Record events in the system memory.

c. Transmit alarm signal to the remote supervising station.

1) Operate alarm relay contacts to initiate the transmission of an alarm to the following:

a) A Central Monitoring Station retained by the Owner via an auto-dialer or within the system control panel.

d. Comply with additional sequences specified under the "Additional Specialized Alarm Actions" paragraph in Part 2 of this section.

C. Additional Specialized Alarm Actions:

1. Fuel Supply Shutoff: Activate emergency fuel supply shutoff to start upon receipt of a General Alarm by the Fire Alarm Control Unit (panel). Comply with the following:

a. Operate control relay contacts to close solenoid valve(s) to shut-off designated gas and fuel supplies. Coordinate and interface with Division 23.

2. Air-Handling System Shut-Down: Upon receipt of a General Alarm by the Fire Alarm Control Unit perform the following, unless otherwise indicated in sequence for smoke venting system in a windowless anesthetizing locations:

a. Operate control relay contacts to signal shutdown of the Air-Handling system(s) serving the evacuation signaling zone where the alarm signal originated. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands. Coordinate and interface with Division 23.

a. Shut the smoke or combination fire/smoke dampers at that specific air-handling units' supply and return connections.
b. Provide for an adjustable time delay, initially set at 20 seconds, to delay the transmission of close signals to the dampers. The intent of this time delay is to allow the air-handling unit fan(s) to receive the stop signal and slow down before closing any dampers in order to avoid a high static-pressure alarm/trip on the air-handling system.

3. Duct-mounted smoke detector: Duct-mounted smoke detector shall initiate the following functions, unless otherwise indicated in sequence for smoke venting system in a windowless anesthetizing locations:

a. Initiate a General Alarm.
b. Shutdown the associated air-handling unit.

c. Shut all smoke and combination fire/smoke dampers associated with associated air-handling system.
d. Provide for an adjustable time delay, initially set at 20 seconds, to delay the transmission of close signal to the dampers. The intent of this time delay is to allow the air-handling unit fan(s) to receive the stop signal and slow down before closing any dampers in order to avoid a high static-pressure alarm/trip on the air-handling system.

4. Smoke Venting System in Windowless Anesthetizing Locations: An alarm signal from a smoke detector, duct-mounted smoke detector, or other initiating device associated with smoke venting system for the anesthetizing location shall operate control relay contacts to initiate the smoke venting system in accordance with the smoke venting sequence specified in Division 23.

a. Initiate General Alarm when the smoke venting system is activated.

b. Coordinate and interface with Division 23.
c. Air-handling systems serving windowless anesthetizing locations shall remain in normal operation during a General Alarm from the Fire Alarm system, unless otherwise indicated in the smoke venting sequence specified in Division 23.
d. Duct-mounted smoke detectors in the air-handling systems associated with the anesthetizing zone shall not be hard-wired to automatically shut down the air-handling system(s) upon detection of smoke. System shall operate in accordance with smoke venting sequence specified in Division 23.
e. Provide separate programmed initiation signals with the required quantity of control relays to meet the requirements of the smoke venting sequence specified in Division 23. Provide separate relays for the following initiation groups:

    1) Duct-Mounted Smoke Detector(s) within the Return Air ducts of the air-handling systems serving the anesthetizing zone.
    2) Duct-Mounted Smoke Detector(s) within the Supply Air ducts of the air-handling systems serving the anesthetizing zone.
    3) Duct-Mounted Smoke Detector(s) on the Outside Air intake for the air-handling systems serving the anesthetizing zone.
    4) Area Smoke Detectors within the anesthetizing zone.
    5) Area Smoke Detectors within the smoke compartment which contains the anesthetizing zone.

f. Provide for an adjustable time delay, initially set at 20 seconds, to delay the transmission of close signals to the dampers. The intent of this time delay is to allow the air-handling unit fan(s) to receive the stop signal and slow down before closing any dampers in order to avoid a high static-pressure alarm/trip on the air-handling system.
g. Smoke Venting System may activate when a General Alarm is received at fire-alarm control unit from initiating device other than those specifically listed in the smoke venting sequence when required by the authorities having jurisdiction. Provide additional hardware and programming to accomplish this function when required by the AHJ.

2.3 FIRE-ALARM CONTROL UNIT (PANEL)

A. Existing to remain.

B. REMOTE ANNUNCIATOR

C. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

D. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.5 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 two-wire or four-wire type, as required.
3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
5. Integral Visible-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.).

C. Duct-Mounted Smoke Detectors: Photoelectric type complying with UL 268A.

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. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.

4. Remote test station with keyswitch, red LED alarm indicator, and green power-on LED.
5. Each sensor shall have multiple levels of detection sensitivity.
6. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
7. Provide relay at each duct-mounted detector for Fan Shutdown, Smoke Damper actuation or Fire/Smoke Damper actuation. Contacts rated to interrupt control circuit.
8. Provide relay at each detector located at an air-handling unit to interface with the Facility Management System (FMS) and communicate the device address and status.

9.

2.6 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.

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.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned, equipped for mounting and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting and with screw terminals for system connections.

B. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the device faceplate.

1. Rated Light Output: 15/30/75/110 cd, selectable in the field.
2. Mounting: Wall mounted, unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red with white lettering.

C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

D. Voice/Tone Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
2. High-Range Units: Rated 2 to 15 W.
3. Low-Range Units: Rated 1 to 2 W.

4. Mounting: Flush, unless otherwise indicated.
5. Matching Transformers: Tap range matched to acoustical environment of speaker location.

## 2.8 CONDUCTORS AND CABLES

A. RS-232 Cable

1. Standard Cable: NFPA 70, Type CM.

   a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
   b. Polypropylene insulation.
   c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
   d. PVC jacket.
   e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
   f. Flame Resistance: Comply with UL 1581.

B. Fire Alarm Wire And Cable

1. Available Manufacturers: Provide products from manufacturers offering products that comply with requirements.
2. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

3. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.

   a. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

4. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

   a. Low-Voltage Circuits: No. 16 AWG, minimum.
   b. Line-Voltage Circuits: No. 12 AWG, minimum.

C. Circuit Class and Style:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.

   **a.** Install no more than 50 addressable devices on each signaling line circuit.

## 2.9 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.

2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
3. Rating: 24-V ac or dc.

B. Material and Finish: Match door hardware.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to the following:

1. Smoke Venting System in windowless anesthetizing location.

PART 3 - EXECUTION

3.1 APPLICATION

A. Remote Alarm Annunciator Panel (FAAP) Locations: Provide Remote Alarm Annunciator panels in the following locations, unless otherwise indicated:

1. Locations as indicated on the Drawings.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Comply with NECA 305 "Standard for Fire Alarm System Job Practices" as published by the National Electrical Contractors Association.

C. Equipment Mounting: Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

D. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

E. 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. Smooth ceiling spacing shall not exceed the listing of the detector.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.

5. HVAC: Locate detectors not closer than 5 feet from air-supply diffuser or 3 feet from return-air opening.
6. Lighting Fixtures: Locate centerline of detectors not closer than 12 inches from any part of a lighting fixture.

F. Duct-Mounted Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes within 10' of straight duct and so they extend the full width of duct. Where installation within 10' of straight duct is not feasible, provide additional sampling tubes as required to protect ductwork branches.

G. Heat Detectors in Elevator Shafts: Coordinate temperature rating, thermal response characteristic and location with sprinkler rating and location.

H. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler waterflow switch and valve-tamper switch that is not readily visible from normal viewing position.

I. Notification Devices: Install devices with appropriate backbox and raceway according to room finish (i.e. flush mounted devices in recessed backboxes with concealed conduit in finished spaces; surface mounted boxes with exposed conduit in unfinished spaces. Refer to Architectural Documents for room finish types.

J. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 WIRING INSTALLATION

A. Install wiring according to the following:

1. NECA 1.
2. TIA/EIA 568-A.
3. Cables, raceways, and support pathways, including but not limited to j-hooks and cable tray, that are used for fire alarm circuits and equipment control wiring associated with the fire alarm system shall not contain any other wire or cable.
4. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.

B. Comply with mounting and support requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."

**C.** Wiring Method for circuits concealed in accessible ceilings, install plenum-rated fire alarm cables supported on j-hooks**.**

1. For wall mounted devices: Install recessed device back boxes with conduit extended to above accessible ceiling according to Division 26 Section "Raceways and Boxes for Electrical Systems."

D. Wiring Method for Smoke Control Systems: Install wiring in metal raceway according to Division 26 Section " Raceways and Boxes for Electrical Systems"

1. Circuits and equipment control wiring associated with the Smoke Control system shall be installed in a dedicated raceway system.

E. Wiring within Enclosures:

1. Separate power-limited and non-power-limited conductors as recommended by manufacturer.
2. Install conductors parallel with or at right angles to sides and back of the enclosure.
3. Bundle, lace, and train conductors to terminal points with no excess.
4. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks.
5. Mark each terminal according to the system's wiring diagrams.
6. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

F. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

G. Wiring to Remote Alarm Transmitting Device: Provide 1-inch (25-mm) conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

H. Conductors: Size according to system manufacturer's written instructions, unless otherwise indicated.

I. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
9.

J. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

## 3.4 CONNECTIONS

A. 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. Alarm-initiating connections to the following:

a. Smoke dampers and combination Fire/Smoke dampers in air ducts of designated air-conditioning duct systems.

b. Smoke-Venting system in windowless anesthetizing locations.
c. Air handling systems for shutdown control relay.

B. Where fire-protection systems are specified in Division 08 Section "Door Hardware" to be integral to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section and 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.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Paint junction box cover plates using red paint. Stencil the letters "FA" in white paint over red background.
2. For all components of the fire alarm system requiring 120VAC power, provide a permanent engraved label at the component indicating the panel and circuit number from which it is fed.

B. Install framed instructions in a location visible from fire-alarm control unit.

C. Color-Coding:

1. Color-code fire alarm conductors differently from the normal building power wiring.
2. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits.
3. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices.

D. Provide a red marking on all circuit breakers feeding any fire alarm control system in accordance with NFPA 72. Provide a permanent engraved label next to the circuit breaker(s) feeding the system that reads "Fire Alarm Control Circuit".

3.6 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.

3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction, as required.

1. Provide 14 days' advance notice of tests and opportunity for observation of tests by Engineer and Owner's representative.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

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.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods.

3.9 CLEANING

A. Clean components according to manufacturer's written instructions.

B. On completion of device box installation but before any wiring devices are installed, inspect interior of boxes and perform the following:

1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

C. On completion of initiation and notification devices installation, inspect exterior surfaces and perform the following:

1. Remove paint splatters and other spots.
2. Remove all temporary markings and labels.
3. Wipe down all devices with approve cleaning agent to remove fingerprints and dust.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's management and maintenance personnel to adjust, operate, and maintain fire-alarm system. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 283100