VAN BUREN PUBLIC SCHOOLS

RAHS BELLEVILLE HIGH SCHOOL
WEST COLUMBIA AVENUE
BELLEVILLE, MICHIGAN

Project Manual

IDS Project No. 24167-1000

January 31, 2025
Bids

Project Manual

Van Buren Public Schools
RAHS Belleville High School
Belleville, Michigan

INTEGRATED design SOLUTIONS
architecture engineering interiors & technology

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IDS Project No. 24167-1000

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SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Project Information.
2. Work covered by Contract Documents.
3. Work under other contracts.
4. Work Performed by Owner.
5. Owner-furnished/Contractor-installed (OFCI) products.
6. Contractor's use of site and premises.
7. Work restrictions.
8. Specification and Drawing conventions.

1.3 PROJECT INFORMATION

A. Project Identification: Van Buren Public Schools, RAHS Belleville High School, IDS Project Number 24167-1000.

1. Project Location: 501 W. Columbia Avenue, Belleville, Michigan.

B. Owner: Van Buren Public Schools.

C. Architect: Integrated Design Solutions, LLC.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. Construction of new early childhood development center as indicated in the Contract Documents.

1.5 WORK UNDER OTHER CONTRACTS

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

1.6 WORK PERFORMED BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.7 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
2. Provide for delivery of Owner-furnished products to Project site.

3. Upon delivery, inspect, with Contractor present, delivered items.

    a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.

4. Obtain manufacturer's inspections, service, and warranties.
5. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Make building services connections for Owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
6. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products:

1. As indicated on Drawings and in Specification Sections.

1.8 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site: 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. Limits on 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. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

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

C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.9 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

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

B. On-Site Work Hours: Limit work to between 7:00 a.m. to 7:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: 7:00 a.m. to 7:00 p.m.

C. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site on Owner's property is not permitted.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

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

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

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

D. 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.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect’s responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

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

1.4 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list 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. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
3. 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.

1.5 SUBMITTAL FORMATS

A. Submittals shall be electronic, unless otherwise indicated.

1. Prepare submittals as a single PDF package, incorporating complete information into PDF file.

a. Name PDF file with submittal number.

B. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

C. Options: Identify options requiring selection by Architect.

D. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

1.6 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare each submittal as a single PDF package and transmit to Architect, through Construction Manager, by sending via email.

a. Send submittals to the following email address:

1) shop_drawings@ids-michigan.com

b. Subject Line: The Subject line of email should indicate the IDS project number, the project name, and specification section number (In this order).
c. IDS submittal form must be completed and included at the beginning of, and in the same PDF, as the submittal.
d. Submit only one specification section in each e-mail.
e. Architect, through Construction Manager, will return review comments in a PDF file.

2. Web-Based Project Management Software: When used for a Project, prepare submittals in PDF form, and upload to web-based Project management software website instead of using email.

    a. Enter required data in web-based software site to fully identify submittal.
    b. IDS submittal form must be completed and included at the beginning of, and in the same PDF, as the submittal.
    c. Submit only one specification section in each e-mail.

B. Submittal Form:

1. Refer to copy of form at the end of this Section.

    a. Additionally, at construction kick-off meeting the Architect will transmit the Submittal Form to the Contractor in both Word and PDF format.

2. Complete and fill out the following information on the submittal form.

    a. Item (1) – Project Title/Location: Refer to Title Page of specifications. Include Bid Package number, if applicable.
    b. Item (2) – From/Return to: Contractor's/Construction Manager's name and address to whom submittal is to be returned
    c. Item (3) - IDS Project No.: Integrated Design Solutions' project number.
    d. Item (4) - Submittal Date:
    e. Item (5) - Submittal Number: Use 1, 2, 3, etc. for easy reference of each separate submittal.
    f. Item (6) - If this is a Partial Submittal of this item, check the box and use "1.1", "1.2", etc. in the submittal number space. If this is a complete submittal, do not check box.
    g. Item (7) - If this is a resubmittal (revision to a previous submittal), check the box and use the original submittal number and number the submittal "1A", "1B", etc in the submittal number space. If this is a new submittal, do not check box.
    h. Item (8) – Project Manual Section No.: Indicate the Project Manual Specification Section number relating to the submittal
    i. Item (9) – Product Manufacturer: Insert name of product manufacturer.
    j. Item (10) - Item Description (specific information, not just "drawings", i.e. Curtainwall Shop Drawings.
    k. Item (11) – Number of copies. Indicate the number of copies, product data, samples, etc. of each item being submitted.
    l. Item (12) – Contractor's/Construction Manager's Remarks & Deviations (if any): Indicate appropriate remarks and note any deviations from the requirements of the Contract Documents, as required, and sign the certification that all submittals have been reviewed.
    m. Item (13) – Addendum or Bulletin (if any): Indicate if submittal information is based on an addendum or bulletin. Indicate number of issue.
    n. Item (14) – Substitution (if any): Indicate whether the submittal was approved under a separate Substitution

C. 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. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, 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.

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

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect, through Construction Manager, will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow 15 days for review of each resubmittal.
3. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is required, allow 21 days for initial review of each submittal.

E. Resubmittals: Make resubmittals in same format as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

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

G. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.7 SUBMITTAL REQUIREMENTS

A. 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 unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

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

a. Wiring diagrams that show 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 Shop Drawings, and before or concurrently with Samples.

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

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

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

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

a. Project name and submittal number.
b. Generic description of Sample.
c. Product name and name of manufacturer.
d. Sample source.
e. Number and title of applicable Specification Section.
f. Specification paragraph number and generic name of each item.

3. Email or Web-Based Transmittal: Provide PDF transmittal. Include digital image illustrating Sample characteristics and identification information for record.

a. In addition to electronic submittal, submit actual 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 one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.

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

    a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

        1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. 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.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit 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. Provide a notarized signature where indicated.
2. 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.
3. 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.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. 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 substrate preparation and primers required.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.8 DELEGATED-DESIGN SERVICES

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

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

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

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
2. When requested by Architect, provide three paper copies of certificate, signed and sealed by the responsible design professional

1.9 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.

1. Email or Web-Based Submittals: Architect will indicate, via markup on each submittal, the appropriate action, as follows:

a. No Exceptions Taken: Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
b. Exceptions As Noted: Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
c. Rejected: Do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary, to obtain different action mark.

1) Do not use, or allow others to use, submittals marked "Rejected" at the Project Site or elsewhere where Work is in progress.

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

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

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

E. Architect will return without review submittals received from sources other than Contractor.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3300

SUBMITTAL FORM

Project Title (1):	
IDS Project No. (3):	
Submittal Date (4):	

From/Return To (2):

Submittal No.(5):		☐ Partial (6)	☐ Resubmittal (7)	IDS Submittal No.:

Project Manual Section No. (8):	
Manufacturer(s) (9):	

Item Description (10)	Print (11)	Product Data	Sample	Other	☐ A	☐ M	☐ E	☐ EN	☐ S	☐ C	☐ DN	☐ FS	☐ IN	☐ TE

Contractor's/Construction Manager's Remarks and Deviations (12):

Addendum or Bulletin: (13)

Substitution: (14)

The undersigned certifies that the above submitted items have been reviewed in detail, including materials, quantities, dimensions, specified performance criteria, installation requirements, catalog numbers and field conditions and are correct and in strict compliance with the Contract Documents, except as the undersigned has noted otherwise. Approval of items does not relieve the Contractor/Construction Manager from complying with all requirements of the Contract Documents. IDS review does not relieve the contractor from responsibility for errors or omissions in this submittal.

Contractor/Construction Manager: _____

Signature _____

IDS Remarks:

IDS Construction Administration Approval:

_____

Date: _____

ACTION CODES:

1. NO EXCEPTIONS TAKEN
2. EXCEPTIONS AS NOTED
3. REJECTED
4. ACTION NOT REQUIRED

IDS Received Stamp

5211 cascade road se, ste. 300
grand rapids, mi 49546

1441 w. long lake road, ste. 200
troy, mi 48098

248-823-2100 www.ids-michigan.com

INTEGRATED design SOLUTIONS
architecture engineering interiors & technology

INSTRUCTIONS

A. Use this form for all submittals. Integrated Design Solutions, will furnish the Contractor/Construction Manager with forms.

B. Organize submittals by Specification Section. Use a separate form for submittals of each Specification Section. **DO NOT SUBMIT ITEMS SPECIFIED IN DIFFERENT SPECIFICATION SECTIONS ON ONE SUBMITTAL FORM**.

C. Fill in submittal form as follows:

(1) Project Title and Location. (Refer to Title Page of specifications. Include Bid Package number, if applicable.)

(2) Contractor's/Construction Manager's name and address to whom submittal is to be returned.

(3) Integrated Design Solutions' project number.

(4) Submittal Date.

(5) Submittal Number: Use 1, 2, 3, etc. for easy reference of each separate submittal.

(6) If this is a Partial Submittal of this item, check the box and use "1.1", "1.2", etc. in the submittal number space. If this is a complete submittal, do not check box.

(7) If this is a resubmittal (revision to a previous submittal), check the box and use the original submittal number and number the submittal "1A", "1B", etc in the submittal number space. If this is a new submittal, do not check box.

(8) Indicate the Project Manual Specification Section number relating to the submittal.

(9) Manufacturer: Insert name of product manufacturer, (e.g., Liebert).

(10) Item Description: Insert a brief statement describing the submitted item in generic terms (e.g. Ceramic Mosaic Tile, etc.) with a list of all drawings or identifying numbers.

(11) No. of Copies: Indicate the number of copies, product data, samples, etc. of each item being submitted (e.g. prints-2, reproducible-1, etc.).

(12) Indicate appropriate remarks and note any deviations from the requirements of the Contract Documents, as required, and sign the certification that all submittals have been reviewed.

(13) Indicate if submittal information is based on an addendum or bulletin. Indicate number of issue.

(14) Indicate whether the submittal was approved under a separate Substitution Request.

D. The balance of this form will be filled in by Integrated Design Solutions, and returned to the Contractor along with the submittal.

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Testing and inspection 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 quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, 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.

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

C. 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, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for one or more of the following:

a. Verify selections made under Sample submittals.
b. Demonstrate aesthetic effects.
c. Demonstrate the qualities of products and workmanship.
d. Demonstrate successful installation of interfaces between components and systems.
e. Perform preconstruction testing to determine system performance.

2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. 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. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

I. 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.

J. 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. Contractor's quality-control services do not include contract administration activities performed by Architect or Construction Manager.

1.4 DELEGATED DESIGN SERVICES

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

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

B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

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

1.6 ACTION SUBMITTALS

A. Mockup Shop Drawings:

1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Contractor's quality-control personnel.

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

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

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

D. Reports: Prepare and submit certified written reports and documents as specified.

E. Permits, Licenses, and Certificates: For Owner's record, 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.

1.8 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, telephone number, and email address 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 inspection.
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, telephone number, and email address 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 of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

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

1. Name, address, telephone number, and email address 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 of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

A. 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. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

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, applying, 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. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

G. 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.

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

I. 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 Contractor's responsibilities, including the following:

1. Provide test specimens representative of proposed products and construction.
2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
5. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
6. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, 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.

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

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect or Construction Manager.
3. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.

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

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

K. Specialty Mockups: See Section 01 4339 "Mockups" for additional construction requirements for integrated exterior mockups.

1.10 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 inspection they are engaged to perform.

2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

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

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. Engage a qualified testing agency to perform quality-control services.

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

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection 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 inspection 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. 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.

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

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

E. 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 Section 013300 "Submittal Procedures."

F. 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.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives 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 inspection. 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 inspection equipment at Project site.

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

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

1.11 SPECIAL TESTS AND INSPECTIONS

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

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Commissioning Authority, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

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, Commissioning Authority's, Construction Manager's and authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

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

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

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

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

END OF SECTION 01 4000

SECTION 01 4200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

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

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

1.3 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.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

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.

1.4 ABBREVIATIONS AND ACRONYMS

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

B. 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.

1. EPA - Environmental Protection Agency; www.epa.gov.
2. OSHA - Occupational Safety & Health Administration; www.osha.gov.
3. USDA - Department of Agriculture; www.usda.gov.

1.5 CODES AND REGULATORY REQUIREMENTS

A. Regulatory requirements applicable to this project: Refer to Drawings.

B. Where Drawings and specification sections reference more current standards or codes, comply with the more restrictive requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 4200

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

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

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

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.

2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

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

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 to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form:

a. Use CSI Form 1.5C during bidding phase.
b. Use CSI Form 13.1A after bidding phase.

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

a. Statement indicating why specified product or fabrication, or installation method cannot be provided, if applicable.
b. Coordination of 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 substitutions 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 as well as 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 substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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

    a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
    b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

B. 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.

C. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.6 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

B. Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

1.8 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 standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

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 meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

    a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole 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.

    a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."

2. Sole 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.

    a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."

3. Limited List of 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 not be considered unless otherwise indicated.

    a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

4. Non-Limited List of 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.

    a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

    a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

6. Non-Limited List of Manufacturers: 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.

    a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally 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.

    a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 2500 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "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.

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

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: 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 the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
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.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 3300 "Submittal Procedures."

1. Form of Approval of Submittal: As specified in Section 01 3300 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

2.3 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

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

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

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

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

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 01 7300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

1.3 DEFINITIONS

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

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

1.4 CLOSEOUT SUBMITTALS

A. Certified statements from existing manufacturers stating that existing warranties have not been affected by cutting and patching work performed under this Section.

1.5 QUALITY ASSURANCE

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

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

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

a. Primary operational systems and equipment.
b. Fire separation assemblies.
c. Air or smoke barriers.
d. Fire-suppression systems.
e. Plumbing piping systems.

f. Mechanical systems piping and ducts.
g. Control systems.
h. Communication systems.
i. Fire-detection and -alarm systems.
j. Electrical wiring systems.

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

a. Water, moisture, or vapor barriers.
b. Membranes and flashings.
c. Equipment supports.
d. Piping, ductwork, vessels, and equipment.
e. Noise- and vibration-control elements and systems.

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

1.6 WARRANTY

A. 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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. 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 sustainable design requirements.

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. Use materials that are not considered hazardous.

C. 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 EXAMINATION

A. Cutting and Patching: Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

B. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

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

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

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

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

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

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

3.2 PREPARATION

A. Cutting and Patching:

1. Temporary Support: Provide temporary support of Work to be cut.
2. 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.
3. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect through Construction Manager

3.3 CUTTING AND PATCHING

A. 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. Temporary Support: Provide temporary support of Work to be cut.

C. 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.

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

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

E. 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, as judged by Architect. 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 eliminate 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, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

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

3.4 INSTALLATION

A. 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.
4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces, unless otherwise indicated on Drawings.

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

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. 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 of type expected for Project.

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: Select tools or equipment that minimize production of excessive 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 portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

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

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, as judged by Architect. Fit exposed connections together to form hairline joints.

J. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 01 7700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.5 COORDINATION OF OWNER'S PORTION OF THE WORK

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

1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
2. Refer to Section 01 1000 "Summary" for other requirements for Owner-furnished, Contractor-installed.

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

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 and Owner's separate contractors 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.

3.6 PROGRESS CLEANING

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

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (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 intended for holding waste materials of type to be stored.

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

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

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

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

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

F. Exposed Surfaces: 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.

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

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

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

3.7 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 4000 "Quality Requirements."

3.8 PROTECTION AND REPAIR 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. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

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

END OF SECTION 01 7300

SECTION 01 7700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.

1.3 DEFINITIONS

A. List of Incomplete Items (Contractor's "punch list"): Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items (Contractor's "punch list"): Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items (Contractor's "punch list"): Final submittal at Final Completion.

1.5 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.7 SUBSTANTIAL COMPLETION PROCEDURES

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

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual 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.

    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 testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
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.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.8 FINAL COMPLETION PROCEDURES

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

1. Submit a final Application for Payment.
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and 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. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.9 LIST OF INCOMPLETE ITEMS (CONTRACTOR'S "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, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Page number.

4. Submit list of incomplete items in one of the following formats as directed by Architect:

    a. PDF Electronic File: Architect, through Construction Manager, will return annotated file.
    b. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.10 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

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

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Architect or by uploading to web-based project software site.

D. Warranties in Paper Form: In addition to the Warranty Electronic File, provide one copy in paper form.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

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

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

a. Clean Project site 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 not planted, mulched, or 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. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
i. Vacuum and mop concrete.
j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
k. 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.
l. Remove labels that are not permanent.
m. Wipe surfaces of mechanical and electrical equipment, elevator 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 luminaires, lamps, globes, and reflectors to function with full efficiency.
r. Clean strainers.
s. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 01 7300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 7700

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

1.3 DEFINITIONS

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

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

1.4 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect and Commissioning Authority (if any) will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

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

1. Submit on digital media acceptable to Architect or by uploading to web-based project software site as directed by Architect. Enable reviewer comments on draft submittals.
2. Submit two paper copies. Architect, through Construction Manager, will return one copies.

a. Paper copies may be omitted with written approval of Architect.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority (if any) 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 at least 15 days before commencing demonstration and training. Architect and Commissioning Authority (if any) will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority (if any) comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority’s (if any) comments and prior to commencing demonstration and training.

E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. 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: Bookmark 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.

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

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

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

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

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

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: 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 Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority (if any).
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. 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. 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."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. 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.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

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

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

C. 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.

D. 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.

E. 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.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

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.

B. 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.

C. 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.

D. 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.

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

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

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

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.

B. 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 warranties and bonds as described below.

C. 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.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; 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.

    a. 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.

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.

E. 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.

F. 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.

G. 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.

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

I. 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.

J. 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 maintenance manuals.

1.11 PRODUCT MAINTENANCE MANUALS

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

B. 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.

C. 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.

D. 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.

E. 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.

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Record Drawings.
2. Record specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Submit annotated PDF electronic files and one paper copies of Record Drawings, including addenda and Contract modifications

1. Paper copies may be omitted with written approval of Architect.

B. Record Specifications: Submit annotated PDF electronic files and one paper copies of Project's Specifications, including addenda and Contract modifications.

1. Paper copies may be omitted with written approval of Architect.

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

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

2. Paper copies may be omitted with written approval of Architect.

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 and one paper copies of each submittal.

1. Paper copies may be omitted with written approval of Architect.

1.4 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 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.
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 prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Formats: Provide both of the following formats unless otherwise directed by Architect.

a. Same digital data software program, version, and operating system as for the original Contract Drawings.
b. Annotated PDF electronic file with comment function enabled.

2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.

a. See Section 01 3300 "Submittal Procedures" for requirements related to use of Architect's digital data files.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

3. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect and Construction Manager.
    e. Name of Contractor.

1.5 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 in the following two formats.

1. Annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Specifications
2. Paper copy.

1.6 RECORD PRODUCT DATA

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. 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.

C. Format:

1. Submit record product data in the following two formats.

    a. Annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Product Data
    b. Paper copy.

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

1.7 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:

1. Submit miscellaneous record submittals in the following two formats.

a. Annotated PDF electronic file or scanned PDF electronic file(s) of marked-up miscellaneous record submittals
b. Paper copy.

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

1.8 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7839

SECTION 01 7900 – DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.3 INFORMATIONAL SUBMITTALS

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

B. Qualification Data: For instructor and facilitator.

1.4 QUALITY ASSURANCE

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

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "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.

1.5 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. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 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. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. 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.

1.7 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 Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

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

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

    1. Owner, through Construction Manager, will furnish Contractor with names and positions of participants.

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

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

D. 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.

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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7900

SECTION 02 4119 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Abandonment and removal of existing utilities and utility structures.
3. Salvage of existing items to be reused or recycled.
4. Reinstalled items.

B. Related Requirements:

1. Section 04 2000 - Unit Masonry: For salvaging existing masonry.
2. Section 04 4200 – Exterior Stone Cladding: For salvaging existing stonework.
3. Section 09 5113 – Acoustic Panel Ceilings: For removing, modifying, and reinstalling portions of existing acoustical panel ceilings.

1.3 DEFINITIONS

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

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

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

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

1.4 MATERIALS OWNERSHIP

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

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For demolition firm.

B. Qualification Data: For refrigerant recovery technician.

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

D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before Work begins.

E. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

1. Minimum of 5 years of documented experience.

1.9 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner may remove items:

C. Notify Construction Manager of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the work.

1. It is the Contractor’s responsibility to contact Owner and verify that hazardous materials have been identified and/or removed prior to the commencement of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Construction Manager and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

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

1. Coordinate with Owner for list of existing warranties still in effect.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.11 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Review Project Record Documents of existing construction or other existing conditions.

B. Perform an engineering survey of 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 building demolition operations.

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

C. Concrete Floor Slabs: Perform ground penetrating radar (GPR) scans or other approved testing of floor slabs prior to demolition to confirm existence and location of rebars, tensioned tendons, electrical conduits, and other embedded materials.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies and Owner.
2. Refer to Divisions 20, 21, 22, 23, 26, 27, and 28 for additional requirements.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 8 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly. Comply with requirements of Division 01.]

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Salvaged Items:

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

D. Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

1. Where concrete cannot be cut full depth, cut concrete to a depth of at least 3/4 inch. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

C. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

D. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to roofing section(s) in Division 07 for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories, unless otherwise indicated on Drawings.
2. Remove existing roofing system down to substrate unless otherwise indicated on Drawings.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Division 01.

B. Burning: Do not burn demolished materials.

3.8 CLEANING

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

END OF SECTION 02 4119

SECTION 03 0130 – CAST-IN-PLACE CONCRETE MAINTENANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cleaning of existing concrete surfaces.
2. Includes stripping existing paint and other thin-films and sealers off concrete.
3. Repair of exposed structural, shrinkage, and settlement cracks.
4. Resurfacing of concrete surfaces having spalled areas and other damage.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.

B. Selection Samples: Where colors and finishes are not specified, submit 3 sets of color and finish selection charts or chips.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Quality-Control Program: Submit a written plan for concrete maintenance to systematically demonstrate the ability of personnel to properly perform maintenance work, including each phase or process, protection of surrounding materials during operations, and control of debris and runoff during the Work. Describe in detail materials, methods, equipment, and sequence of operations to be used for each phase of the Work.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least 5 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience and as follows:

1. Engage an experienced concrete-maintenance firm that employs installers and supervisors who are trained and approved by manufacturer.
2. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

B. Store cementitious materials off the ground, under cover, and in a dry location.

1.7 FIELD CONDITIONS

A. Cold-Weather Requirements for Cementitious Materials: Do not apply unless concrete-surface and air temperatures are above 40 deg F and will remain so for at least 48 hours after completion of Work.

B. Hot-Weather Requirements for Cementitious Materials: 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 required. Do not apply to substrates with temperatures of 90 deg F and above.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Detergent: Non-ionic detergent.

2.2 STRIPPERS

A. Strippers: Fast acting gel that quickly removes thin-film coatings and clear coats from concrete.

1. Standard Stripper: Removes basic paints and sealers.

a. Product: Subject to compliance with requirements, provide Prosoco, Inc.; Enviro Klean SafStrip: www.prosoco.com, or a comparable product from one of the following:

1) Dietrich Technologies, Inc.: www.diedrichtechnologies.com.

2. Heavy Duty Stripper: Removes high-strength paints and coatings such as epoxies, polyurethanes, and enamels.

a. Product: Subject to compliance with requirements, provide Prosoco, Inc.; Sure Klean Fast Acting Stripper: www.prosoco.com, or a comparable product from one of the following:

1) Dietrich Technologies, Inc.: www.diedrichtechnologies.com.

2.3 CEMENTITIOUS PATCHING AND REPAIR MATERIALS

A. Repair Mortar (Type A) for Horizontal (Traffic) Repairs: Latex and microsilica modified cementitious repair mortar containing a corrosion inhibitor.

1. Properties:

a. Compressive Strength (ASTM C109): 9,000 psi at 28 days, minimum.
b. Flexural Strength (ASTM C 348): 1000 psi at 28 days, minimum.
c. Freeze/Thaw Resistance (ASTM C 666, Procedure A): 300 Cycles; 92 percent relative dynamic modulus.
d. Application Depth: 3/8 inch to 2 inches.
e. Color: Gray.

2. Product: Subject to compliance with requirements, provide The Euclid Chemical Company; Concrete-Top Supreme: www.euclidchemical.com, or a comparable product from one of the following:

a. BASF, Master Builders Solutions: www.master-builders-solutions.com.
b. Dayton Superior Corp.: www.daytonsuperior.com.

c. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc.: www.laticrete.com.
d. Sika Corp.: usa.sika.com.

B. Repair Mortar (Type B) for Vertical and Overhead Repairs: Latex and microsilica modified, non-sag, cementitious repair mortar containing a corrosion inhibitor.

1. Properties:

a. Compressive Strength (ASTM C109): 5,000 psi at 28 days, minimum.
b. Flexural Strength (ASTM C 348): 1000 psi at 28 days, minimum.
c. Freeze/Thaw Resistance (ASTM C 666, Procedure A): 300 Cycles; 90 percent relative dynamic modulus.
d. Application Depth: 1/4 inch to 2 inch lifts.
e. Color: Gray.

2. Product: Subject to compliance with requirements, provide The Euclid Chemical Company; Verticoat Supreme: www.euclidchemical.com, or a comparable product from one of the following:

a. BASF, Master Builders Solutions: www.master-builders-solutions.com.
b. Dayton Superior Corp.: www.daytonsuperior.com.
c. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc.: www.laticrete.com.
d. Sika Corp.: usa.sika.com.

C. Repair Mortar (Type C) for Formed Repairs - Horizontal, Vertical, or Overhead: Latex and microsilica modified cementitious repair mortar containing a corrosion inhibitor.

1. Properties:

a. Compressive Strength (ASTM C109): 10,000 psi at 28 days, minimum.
b. Flexural Strength (ASTM C 348): 1000 psi at 28 days, minimum.
c. Freeze/Thaw Resistance (ASTM C 666, Procedure A): 300 Cycles; 81 percent relative dynamic modulus.
d. Application Depth: 1 inch to full depth.
e. Color: Gray.

2. Product: Subject to compliance with requirements, provide The Euclid Chemical Company; Eucocrete Supreme: www.euclidchemical.com, or a comparable product from one of the following:

a. BASF, Master Builders Solutions: www.master-builders-solutions.com.
b. Dayton Superior Corp.: www.daytonsuperior.com.
c. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc.: www.laticrete.com.
d. Sika Corp.: usa.sika.com.

D. Repair Mortar (Type D) for Minor Repairs and Patching - Horizontal or Vertical: Latex modified cementitious repair mortar.

1. Properties:

a. Compressive Strength (ASTM C109): 5,000 psi at 28 days, minimum.
b. Flexural Strength (ASTM C 348): 900psi at 28 days, minimum.
c. Freeze/Thaw Resistance (ASTM C 666, Procedure A): 300 Cycles; 91 percent relative dynamic modulus.
d. Application Depth: Featheredge to 1 inch.
e. Color: Gray.

2. Product: Subject to compliance with requirements, provide The Euclid Chemical Company; Tammspatch II: www.euclidchemical.com, or a comparable product from one of the following:

   a. BASF, Master Builders Solutions: www.master-builders-solutions.com.
   b. Dayton Superior Corp.: www.daytonsuperior.com.
   c. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc.: www.laticrete.com.
   d. Sika Corp.: usa.sika.com.

2.4 BONDING AGENTS AND ANTI-CORROSION COATINGS

A. Bonding Agent (Type A) with Anti-Corrosion Coating: Multi-component, water-based epoxy and cementitious bonding agent containing a corrosion inhibitor.

1. Properties:

   a. Compressive Strength (ASTM C109): 4,000 psi at 28 days, minimum.
   b. Flexural Strength (ASTM C 348): 1000 psi at 28 days, minimum.
   c. Bond Strength (ASTM C 882): 2000 psi at 7 days, minimum.
   d. Shore D Hardness (ASTM D 2240): 90 to 95.
   e. Color: Gray.

2. Product: Subject to compliance with requirements, provide The Euclid Chemical Company; Duralprep A.C.: www.euclidchemical.com, or a comparable product from one of the following:

   a. BASF, Master Builders Solutions: www.master-builders-solutions.com.
   b. Dayton Superior Corp.: www.daytonsuperior.com.
   c. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc.: www.laticrete.com.
   d. Sika Corp.: usa.sika.com.

B. Bonding Agent (Type B) for Anchoring Reinforcing Steel: Two-component, 100 percent solids, non-corrosive, moisture insensitive, epoxy, non-sag, adhesive gel.

1. Properties:

   a. Compressive Strength (ASTM D 695): 10,000 psi at 7 days, minimum.
   b. Bond Strength (ASTM C 882): 2000 psi at 14 days, minimum.
   c. Shore D Hardness (ASTM D 2240): 90 to 95.

2. Product: Subject to compliance with requirements, provide The Euclid Chemical Company; Dural 452 Gel: www.euclidchemical.com, or a comparable product from one of the following:

   a. BASF, Master Builders Solutions: www.master-builders-solutions.com.
   b. Dayton Superior Corp.: www.daytonsuperior.com.
   c. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc.: www.laticrete.com.
   d. Sika Corp.: usa.sika.com.

2.5 ACCESSORIES

A. Water: Potable.

B. Reinforcing Steel: ASTM A615 Grade 40 (40,000 psi) billet-steel deformed bars, epoxy coated in accordance with ASTM A775.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Locate areas of deteriorated or delaminated concrete using visual inspection and other methods as recommended by installer and mark boundaries.

C. Do not begin any work until all mockups have been approved by the Architect.

D. Perform surveys as the Work progresses to detect hazards resulting from concrete-maintenance work.

3.2 PREPARATION

A. Provide enclosures, barricades, and other temporary construction as required to protect adjacent work from damage.

B. Protect persons, motor vehicles, surrounding surfaces of building being repaired, building site, plants, and surrounding buildings from harm resulting from concrete maintenance work.

1. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

    a. Use only proven protection methods appropriate to each area and surface being protected.
    b. Protect floors and other surfaces along haul routes from damage, wear, and staining.

2. Provide temporary barricades, barriers, and directional signage to exclude public from areas where concrete maintenance work is being performed.

    a. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of concrete maintenance work.

3. Contain dust and debris generated by concrete maintenance work and prevent it from reaching the public or adjacent surfaces.

    a. Use water-mist sprinkling and other wet methods to control dust only with adequate, approved procedures and equipment that ensure that such water will not create a hazard or adversely affect other building areas or materials.

4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
5. Dispose of debris and runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

C. Preparation for Concrete Removal: Examine construction to be repaired to determine best methods to safely and effectively perform concrete maintenance work. Examine adjacent work to determine what protective measures will be necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed in the course of repair.

1. Inventory and record the condition of items to be removed for reinstallation.
2. Provide and maintain shoring, bracing, and temporary structural supports as required to preserve stability and prevent unexpected or uncontrolled movement, settlement, or collapse of construction being demolished and construction and finishes to remain. Strengthen or add new supports when required during progress of removal work.

3.3 PAINT REMOVAL

A. Remove all paint, sealers, and other thin film coatings from exposed concrete using standard and heavy duty strippers as appropriate for the coating being removed.

1. Apply strippers according to manufacturer's written instructions.
2. Work from the bottom to the top.
3. Do not let the applied stripper dry; occasionally agitate applied stripper with a stiff bristle brush.
4. After applied stripper has set for 15-30 minutes, rinse with low-pressure water; ensure that all stripper and dissolved coatings are completely removed from the concrete surface and surface pores.
5. Repeat stripping process as necessary to completely remove all coatings.

    a. Ensure that all coatings are completely removed from the concrete substrates.

3.4 CLEANING EXISTING CONCRETE

A. Clean concrete surfaces of dirt or other contamination using the gentlest method that is effective.

1. Try the gentlest method first, then, if not clean enough, use a less gentle method taking care to watch for impending damage. Stop immediately if cleaning method causes additional damage.
2. Clean out cracks and voids using same methods.

B. The following are acceptable cleaning methods, in order from gentlest to less gentle:

1. Water washing using low-pressure, maximum of 50 psi, and, if necessary, brushes with natural or synthetic bristles.
2. Increasing the water washing pressure to maximum of 400 psi.
3. Adding detergent to washing water; with final water rinse to remove residual detergent.

C. Do not use any of the following cleaning methods, unless otherwise indicated:

1. Brushes with wire bristles, grinding with abrasives, solvents, hydrochloric or muriatic acid, sodium hydroxide, caustic soda, or lye.
2. Soap or detergent that is not non-ionic.

3.5 CRACK REPAIR

A. Fine to Medium Cracks:

1. Size: Cracks that are less than 12 mils (0.012 inches) in width.

2. Repair Method: Remain as-is. Do not repair.

B. Large Cracks:

1. Size: Cracks that are wider than 12 mils (0.012 inches) in width.
2. Repair Method: Route and seal.

    a. Remove all dirt and debris from cracks.
    b. Remove all loose and spalling concrete from the edges of the cracks.
    c. Route out cracks to create a 1/2 inch wide by 1/2 deep groove for sealant.
    d. Apply a bond breaker to the bottom of the groove and fill groove with sealant; strike off sealant flush with surface of concrete or tool sealant concave.

        1) Refer to Section 07 9200 for sealant and bond breaker installation.

3.6 DETERIORATED CONCRETE REPAIR

A. General: Remove and replace deteriorated concrete that has severely cracked, spalled or delaminated. Remove and replace failed concrete repair patches.

1. Comply with the American Concrete Institute (ACI) Repair Guide, ACI 546R-14 and the International Concrete Repair Institute (ICRI) Repair Guideline No. 310.1R-08.

B. Concrete Removal: Saw cut perimeter and remove deteriorated concrete by breaking up and dislodging from steel reinforcement.

1. Remove concrete a minimum of 1/4 inch beyond deteriorated concrete.

a. Test areas where concrete has been removed by tapping with hammer and remove any additional concrete failures until only sound concrete remains.

2. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar and to provide at least 3/4-inch clearance around bar to completely expose steel.
3. Thoroughly clean removal areas of loose concrete, dust, and debris.

C. Concrete Patching:

1. Wet substrate thoroughly to attain a saturated surface dry condition (SSD) with no standing water.
2. Apply bonding agent and anti-corrosion coating according to the manufacturer's written instructions and as follows:

a. Apply Bonding Agent Type A to all existing concrete and reinforcing steel that will be patched with repair mortar.

1) Apply Type A Bonding Agent to reinforcing steel in two coats.

3. Apply repair mortar according to the manufacturer's written instructions and as follows:

a. For vertical or horizontal minor repairs up to 1/2 inch deep, including surface holes, voids, and shallow spalling, use Repair Mortar Type D for minor repairs and patching.
b. Use Repair Mortar Type A for all horizontal (traffic) repairs greater than 1/2 inch deep.

1) If depth of repair exceeds 2 inches use Repair Mortar Type C for formed repairs.

c. Use Repair Mortar Type B for all vertical and overhead repairs greater than 1/2 deep.

1) If depth of repair exceeds 2 inches use Repair Mortar Type C for formed repairs or apply Repair Mortar Type B, in lifts.
a) Do not to exceed the maximum lift depth as recommended by the manufacturer of the vertical repair mortar.

d. Place repair mortar by troweling toward edges of patch to promote a solid bonding at the perimeter of the patch.
e. For large patches fill the edges first and then work towards the center, always troweling towards the edges of the patch.
f. At reinforcing steel, force repair mortar to fill space behind bars by compacting repair mortar with trowel from each exposed side of steel.
g. Do not exceed the maximum depth for each applied lift.
h. Repair mortar shall be flush with surface of adjacent existing concrete.

i. Finish to match adjacent existing concrete surfaces.
j. Wet cure repair mortar for not less than seven days by water-fog spray or water-saturated absorptive cover.

END OF SECTION 03 0130

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, and finishes.
2. Steel reinforcement bars and welded-wire reinforcement.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete Subcontractor.

2. Review the following:

a. Vapor-retarder installation.
b. Steel-reinforcement installation
c. Anchor rod and anchorage device installation tolerances.
d. Construction joints, control joints, isolation joints, and joint-filler strips.
e. Concrete finishes and finishing.
f. Floor and slab flatness and levelness measurements.
g. Cold and hot weather concreting procedures.
h. Curing procedures.
i. Concrete repair procedures.
j. Concrete protection.
k. Special inspection and testing and inspecting agency procedures for field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product and material.

B. Design Mixtures: For each concrete mixture.

1. Include indication where each mix design will be used.

2. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout:

a. Indicate proposed construction joints required to construct the structure.

1) Location of construction joints is subject to approval of the Architect.

2. Concrete Reinforcement:

a. Include placing drawings that detail fabrication, bending, and placement.
b. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing and inspection agency: Include copies of applicable ACI certificates.

B. Welding certificates.

1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories
4. Floor and slab treatments.
5. Bonding agents.
6. Vapor retarders.
7. Joint-filler strips.
8. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:

a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

5. Steel Reinforcement:

E. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

F. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder, showing compliance with ICC AC380.

G. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment; with not less than 5 years of documented experience.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete and incorporating permeability-reducing admixtures.

1. Supervisors shall have not less than 5 years of documented experience

C. Obtain permeability-reducing (moisture vapor reduction) admixture from a single manufacturer.

D. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

E. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

F. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94 and ACI 301.

B. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.10 WARRANTY

A. Slabs with Permeability-Reducing (Moisture Vapor Reduction) Admixture: Provide warranty to cover the cost of water vapor permeance testing failures and flooring failures due to moisture migration from slabs for ten years.

1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete:

1. Comply with ACI 301 unless modified by requirements in the Contract Documents.

a. Provide construction and movement joints required to construct the structure in accordance with ACI 301.

1) Location of construction joints is subject to approval of the Architect.

2. Concrete Reinforcement shall comply with ACI SP-066.

B. Water Vapor Emission and Relative Humidity:

1. Concrete mix designs with a permeability-reducing (moisture vapor reduction) admixture shall comply with the following:

a. Concrete shall have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours per ASTM F1869 (Anhydrous Calcium Chloride Test).
b. Concrete shall have a maximum 75 percent relative humidity level measurement per ASTM F2170 (Relative Humidity Test, using in situ probes).

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150, Type I, or ASTM C595, Type IL, gray or white.
2. Fly Ash: ASTM C618, Class C or F.

C. Normal-Weight Aggregates: ASTM C33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Provide Class 4S at exterior flatwork and wet interior flatwork areas.
2. Maximum Coarse-Aggregate Size: 1 inch nominal, unless otherwise indicated.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

2.3 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260.

B. Permeability-Reducing (Moisture Vapor Reduction) Admixture: ASTM C494, Type S, hydrophilic, permeability-reducing crystalline admixture, capable of reducing water absorption of concrete exposed to hydrostatic pressure (PRAH); formulated to permanently close capillary systems formed during curing to reduce moisture vapor emission and transmission with no adverse effect on concrete properties or finish flooring.

1. Water Vapor Permeance: Comply with one or more of the following:

a. 0.03 perms, maximum, when tested in accordance with ASTM E96.
b. $6x10^{-8}$ cm/s, maximum, in accordance with ASTM D5084.

2. Products: Subject to compliance with requirements, provide one of the following:

a. Barrier One, Inc; CPS Admix - Moisture Vapor Reduction Admixture (MVRA): www.barrierone.com.
b. ISE Logik Industries, Inc; MVRA 900: www.iselogik.com.
c. Specialty Products Group; Vapor Lock 20/20: www.spggogreen.com.

C. Other Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494, Type A.
2. Retarding Admixture: ASTM C494, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017, Type II

D. Water and Water Used to Make Ice: ASTM C94, potable

2.4 STEEL REINFORCEMENT

A. Fabricating Reinforcement

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

B. Reinforcing Bars: ASTM A615, Grade 60, deformed.

C. Steel Bar Mats: ASTM A184, fabricated from ASTM A615, Grade 60, deformed bars, assembled with clips.

D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064, plain, fabricated from as-drawn steel wire into flat sheets.

2.5 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

C. Steel Tie Wire: ASTM A1064, annealed steel, not less than 0.0508 inch in diameter.

1. Finish: Plain.

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E1745, Class A; not less than 15 mils thick with a permeance of not more than 0.01 Perms. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Henry Company, a Carlisle Company: Moistop Ultra 15 www.henry.com.
b. Inteplast Group; Barrier-Bac, VB-350: www.barrierbac.com.
c. Reef Industries, Inc.; Griffolyn 15 Mil: www.reefindustries.com.
d. Stego Industries, LLC; Stego Wrap Vapor Barrier (15 Mil): www.stegoindustries.com.
e. Viaflex, Inc.; VaporBlock VB15: www.viaflex.com.
f. W. R. Meadows, Inc; Perminator 15 Mil: www.wrmeadows.com.

2.7 LIQUID FLOOR TREATMENTS

A. Concrete Hardener/Densifier (Sealer): Penetrating liquid floor treatment. Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dayton Superior; Densifier J13: www.daytonsuperior.com.
b. The Euclid Chemical Company; Euco Diamond Hard: www.euclidchemical.com.
c. Kaufman Products, Inc; SureHard: www.kaufmanproducts.net.
d. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; Seal Hard: www.lmcc.com.
e. PROSOCO, Inc; Consolideck LS: www.prosoco.com.
f. W.R. Meadows, Inc; Liqui-Hard: www.wrmeadows.com.

2.8 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F: Black.
b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
c. Ambient Temperature Above 85 deg F: White.

C. Water: Potable or complying with ASTM C1602/C1602M.

2.9 RELATED MATERIALS

A. Bonding Agents: Provide one or more of the following:

1. Latex Bonding Agent: ASTM C1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
2. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

a. Types I and II, nonload bearing and Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

B. Expansion- and Isolation-Joint-Filler Strips:

1. Size and Configuration: Unless otherwise indicated, 1/2 inch thick by height equal to slab thickness, optionally with removable top section that will form 1/2 inch deep sealant pocket after removal.
2. Materials: Provide products manufactured from one or more of the following:

a. Cellulose fiber, ASTM D1751.
b. PVC (Type IV), ASTM D1752.
c. Semi-rigid, closed-cell polypropylene foam ASTM D8139.

3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

a. Oscoda Plastics, Inc; Proflex Vinyl Expansion Joints: www.oscodaplastics.com.
b. W. R. Meadows, Inc; Fiber Expansion Joint Filler with Snap-Cap: www.wrmeadows.com.
c. W. R. Meadows, Inc; Deck-O-Foam Joint Filler with pre-scored top strip: www.wrmeadows.com.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Total Fly Ash and Pozzolan: 25 percent by mass.

C. Permeability-Reducing (Moisture Vapor Reduction) Admixture:

1. Provide in slabs to receive adhesively applied flooring and moisture sensitive floor finishes.

a. Includes, but is not limited to, the following:

1) Resilient tile and sheet.
2) Carpet tile and sheet carpeting.
3) Wood gymnasium flooring.
4) Wood stage flooring.
5) Epoxy matrix terrazzo flooring.
6) Other adhesive applied floor finishes.

D. Other Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, and concrete with a w/cm below 0.50.

2.11 CONCRETE MIXTURES

A. Class D: Normal-weight concrete used for interior slabs-on-grade and equipment pads.

1. Exposure Class: ACI 318 F0.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.50.
4. Minimum Cementitious Materials Content: 520 lb/cu. yd.
5. Air Content: Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
6. Permeability-Reducing (Moisture Vapor Reduction) Admixture: Provide in slabs to receive adhesively applied flooring and moisture sensitive floor finishes.

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94 and ASTM C1116 and furnish batch ticket information.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.2 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damaged area by 6 inches on all sides, and sealing to vapor retarder.

3.3 INSTALLATION OF STEEL REINFORCEMENT

A. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

B. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

C. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

D. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

E. Provide concrete coverage in accordance with ACI 318.

F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

G. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.

H. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

    a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.4 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Grade: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. At Contractor’s option one or more of the following methods may be used:

    a. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
    b. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 07 9200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Do not proceed until unsatisfactory conditions have been corrected.
2. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
3. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.6 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel or broom finish.

C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to all interior slab surfaces, unless otherwise indicated.

3.7 TOLERANCES

A. Conform to ACI 117.

3.8 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ACI 117 and ASTM E1155, within 48 hours after slab installation; report both composite overall values and local values for each measured section.

1. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.
2. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values: F(L) applies to on-grade slabs only.

1. Exposed to View (without a finish flooring material) and Foot Traffic: F(F) of 25; F(L) of 20.
2. At Floors Receiving Finish Flooring Material (except as otherwise indicated in this list): F(F) of 35; F(L) of 25.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.

3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.

B. Curing Unformed Surfaces:

1. Begin curing immediately after finishing concrete.

a. Interior Concrete Floors: Cure for not less than seven days.

C. Cure concrete according to ACI 308.1 and by one or a combination of the following methods:

1. Moisture Curing:

a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
b. Continuous Sprinkling: Maintain concrete surface continuously wet.
c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

a. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

3.11 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Concrete Hardener/Densifier: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs prior to applying liquid floor treatment.
2. Locations:

a. Unless otherwise indicated, provide at unfinished exposed concrete floors, equipment pads, ramps, steps, and stairs.

3.12 JOINT FILLING

A. Refer to Section 07 9200 - Sealants.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

    a. Limit cut depth to 3/4 inch.
    b. Make edges of cuts perpendicular to concrete surface.
    c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    d. Fill and compact with patching mortar before bonding agent has dried.
    e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

    a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.

6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

    a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    b. Dampen cleaned concrete surfaces and apply bonding agent.

c. Place patching mortar before bonding agent has dried.
d. Compact patching mortar and finish to match adjacent concrete.
e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports shall include reporting requirements of ASTM C31, ASTM C39, and ACI 301,

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
2. Steel-reinforcement placement.
3. Steel-reinforcement welding.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day
2. Slump: ASTM C143:

a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
b. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231 pressure method, for normal-weight concrete:

a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064:

    a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C31:

    a. Cast and laboratory cure two sets of two 6-inch by 12-inch or three sets of 4-inch by 8-inch cylinder specimens for each composite sample.

    b. Cast and laboratory cure two sets of two 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
    c. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C39.

    a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
    b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
    c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 10 percent of specified compressive strength.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests:

    a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.

        1) Acceptance criteria for concrete strength shall be in accordance with ACI 301, section 1.6.6.3.

11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ACI 117 and ASTM E1155 within 24 hours of completion of floor finishing and promptly report test results to Architect.

G. Water Vapor Permeance Testing:

1. Allow manufacturer of Permeability-Reducing (Moisture Vapor Reduction) Admixture access to concrete work for any concrete sampling and testing required by admixture manufacturer for compliance with warranty requirements.

2. Refer to Division 09 Finishes sections for water vapor permeance testing required as part of floor finish installations.
3. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents; at no additional costs to Owner.

3.15 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. 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 03 3000

SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Cold-formed metal framing.

1.3 DEFINITIONS

A. CFMF: Cold-formed metal framing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: Shop drawings and calculations for cold-formed steel framing; sealed by a professional engineer.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer, installer and professional engineer.

B. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Mechanical fasteners.
4. Vertical deflection clips.
5. Miscellaneous structural clips and accessories.

C. Research Reports:

1. For nonstandard cold-formed steel framing post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

C. Professional Engineer Qualifications: Professional engineer experienced with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the state in which Project is located.

D. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

E. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the following:

1. ClarkDietrich Building Systems: www.clarkdietrich.com.
2. Jaimes Industries Inc.: www.jaimesind.com.
3. Marino\WARE: www.marinoware.com.
4. MBA Building Supplies, Inc.: www.mbastuds.com.
5. MRI Steel Framing LLC: www.mristeelframing.com
6. Telling Industries; www.buildstrong.com.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 - Quality Requirements, to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Unless otherwise indicated, design framing systems to withstand design loads without deflections greater than the following:

    a. Roof Rafter Framing:

        1) Vertical deflection of L/240 of the horizontally projected span for live loads.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

    a. Upward and downward movement of 3/4 inch, unless otherwise indicated.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: ST33H but not less than as required by structural performance requirements.
2. Coating: G60; exception, provide G90 at masonry stud backup.

B. Steel Sheet for Clips: ASTM A653, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 33 (230) but not less than as required by structural performance.
2. Coating: G60.

2.4 ROOF-RAFTER FRAMING

A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (16 gage).
2. Minimum Flange Width: 2 inches.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing and bridging.
3. Web stiffeners.
4. Miscellaneous Clips.
5. Backer plates.
6. And other miscellaneous items required for a complete installation.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36, zinc coated by hot-dip process according to ASTM A123.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts and headless, hooked bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
3. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780 or SSPC-Paint 20.

2.8 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

D. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

1. Install web stiffeners to transfer axial loads of walls above.

E. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Combination Bridging: Combination of flat, taut, steel sheet straps, and joist-track solid blocking as indicated on Shop Drawings. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

F. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

G. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.5 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

3.7 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 4000

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Miscellaneous lumber.
2. Miscellaneous panels and sheathing.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

B. Timber: Lumber of 5 inches nominal size or greater in least dimension.

C. Lumber grading agencies, and abbreviations used to reference them, include the following:

1. NLGA: National Lumber Grades Authority.
2. SPIB: The Southern Pine Inspection Bureau.
3. WCLIB: West Coast Lumber Inspection Bureau.
4. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

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

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 LUMBER PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 SHEATHING AND PANEL PRODUCTS, GENERAL

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.3 WOOD-PRESERVATIVE-TREATED LUMBER

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Lonza Group: www. wolmanizedwood. com.
2. Hoover Treated Wood Products, Inc.: www. frtw. com.
3. Koppers Performance Chemicals, Inc.: www. koppersperformancechemicals. com.
4. Viance, LLC: www. treatedwood. com.

B. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

    a. Inorganic boron (SBX) is prohibited.

2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

D. Kiln-dry plywood and other wood panels after treatment to maximum moisture content of 15 percent.

E. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

F. Identify fire-retardant-treated plywood and panels with appropriate classification marking of qualified testing agency.

1. For exposed plywood and other wood panels indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

G. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

a. At Contractor's option, roof nailers may be non-preservative treated.

2. Plywood and other wood paneling in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing
3. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
4. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
5. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
6. Wood floor plates that are installed over concrete slabs-on-grade.
7. Other items as indicated on Drawings.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Lonza Group: www. wolmanizedwood. com.
2. Hoover Treated Wood Products, Inc.: www. frtw. com.
3. Koppers Performance Chemicals, Inc.: www. koppersperformancechemicals. com.
4. Viance, LLC: www. treatedwood. com.

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

C. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

D. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

E. Identify fire-retardant-treated lumber with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing agency.

F. Identify fire-retardant-treated plywood and other wood panels with appropriate classification marking of qualified testing agency.

1. For exposed plywood and other wood paneling indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing agency.

G. Application: Treat items indicated on Drawings, and the following:

1. All interior rough carpentry items unless otherwise indicated.
2. Other items as indicated on Drawings.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Miscellaneous framing, blocking, furring and nailers

B. Dimension Lumber Items:

1. Species: Provide one of the following:

a. Southern pine or mixed southern pine; SPIB.
b. Spruce-pine-fir; NLGA.
c. Hem-fir; WCLIB, or WWPA

2. Grade: No. 2 or as follows:

a. Standard Grade, provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

D. For furring strips for installing plywood or other paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 MISCELLANEOUS PANELS AND SHEATHING

A. Plywood Concealed from View and Part of Exterior Enclosure: DOC PS 1, Exposure 1, Grade C-D

B. Concealed Plywood at Interior Locations: DOC PS 1, Exposure 2, Grade C-D.

2.7 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

D. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

D. Do not splice structural members between supports unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use copper naphthenate for items not continuously protected from liquid water.

H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in Michigan Building Code.
2. ICC-ES evaluation report for fastener.

I. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 PANEL AND SHEATHING INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

3.3 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

END OF SECTION 06 1000

SECTION 06 4023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cabinets and millwork.

    a. Plastic laminate clad cabinets and millwork.

2. Countertops.

    a. Solid surfacing countertops.

3. Plastic laminate panels below countertops.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product, including, but not limited to, the following:

1. Cabinet hardware and other accessories.
2. Adhesives.
3. Shop finishing materials.
4. Wood-Preservative Treatment:

    a. Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
    b. Indicate type of preservative used and net amount of preservative retained.
    c. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty.

5. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
6. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories

1. Include the following:

a. Dimensioned plans, elevations, and sections.
b. Attachment details.

2. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
3. Show locations and sizes of cutouts and holes for items installed in architectural woodwork

C. Samples for Initial Selection:

1. Where colors and finishes are not specified, submit 3 sets of color and finish selection charts or chips

D. Samples or Verification: For each exposed product and for each shop-applied color and finish specified. Provide three samples of each of the following:

1. Plastic Laminates: 12 by 12 inches, for each type, color, pattern, and surface finish.
2. Solid Surfacing: 4 by 4 inches, for each type, color, pattern, and finish.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Evaluation Reports: For preservative-treated and fire-retardant-treated wood materials, from ICC-ES.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating and installing the products specified in this section with minimum five years of documented experience

1. Fabricator shall also be the installer.

B. Single Source Responsibility: Provide and install interior architectural woodwork from single fabricator.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Architectural Woodwork Standards, Section 2.

B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.

B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents may contain requirements that are more stringent than the Architectural Woodwork Standards. Comply with Contract Documents and Architectural Woodwork Standards.

B. Wood Moisture Content: Comply with requirements of the Architectural Woodwork Standards for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas and as follows:

1. Wood Moisture Content: 5 to 10 percent.

2.2 WOOD MATERIALS

A. Hardwood Lumber: As indicated in this section for each item specified.

B. Hardwood Plywood (Veneer-Faced Panel Products): As indicated in this section for each item specified and as follows:

1. HPVA HP-1.
2. Made with adhesive containing no urea formaldehyde.

C. Softwood Plywood: DOC PS 1.

1. Made with adhesive containing no urea formaldehyde.

D. Medium Density Overly (MDO) Plywood: MDO-General, DOC PS 1, Exterior, Grade B-C.

1. Provide smooth resin-impregnated surface ply, approximately 1/16 inch thick, bonded to one each face.

E. Particleboard (Medium Density): ANSI A208.1, Grade M-2.

1. Made with binder containing no urea formaldehyde.

F. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.

1. Made with binder containing no urea formaldehyde.

2.3 PRESERVATIVE-TREATED-WOOD MATERIALS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Lonza Group: www.wolmanizedwood.com.

2. Hoover Treated Wood Products, Inc.: www.frtw.com.
3. Koppers Performance Chemicals, Inc.: www.koppersperformancechemicals.com.
4. Viance, LLC: www.treatedwood.com.

B. Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWPA N1 (dip, spray, flood, or vacuum-pressure treatment).

1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC).
2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

C. Extent of Preservative-Treated Wood Materials: Treat interior architectural woodwork in contact with concrete or masonry.

2.4 FIRE-RETARDANT-TREATED WOOD MATERIALS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Lonza Group: www.wolmanizedwood.com.
2. Hoover Treated Wood Products, Inc.: www.frtw.com.
3. Koppers Performance Chemicals, Inc.: www.koppersperformancechemicals.com.
4. Viance, LLC: www.treatedwood.com.

B. Fire-Retardant-Treated Wood Materials: Where fire-retardant-treated materials are indicated, use materials complying with requirements that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products according to test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of the Architectural Woodwork Standards. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

C. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained, transparent, or natural finish, use organic resin chemical formulation.

D. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less according to ASTM E84.

1. For panels 3/4 inch (19 mm) thick and less, comply with ANSI A208.1 for Grade M-2, except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.

E. Fire-Retardant Fiberboard: Medium-density fiberboard (MDF) 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 according to ASTM E84.

2.5 LAMINATE MATERIALS

A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as indicated or recommended for specific applications.

1. Manufacturers: Subject to compliance with requirements, provide products as indicated in Color Codes on Drawings. Substitutions not permitted.
2. Colors, Patterns, and Finishes: As indicated in Color Codes on Drawings

    a. For semiexposed Grade CLS laminate: Color to be white.

B. Edgebanding: Rigid PVC extrusions, flat shaped, smooth texture, through color with satin finish. Width to match component thickness. Match adjacent laminate in color, pattern, and finish.

1. 0.118 inch (3 mm) thick at doors, drawer fronts and countertops.
2. 0.039 inch (1 mm) thick elsewhere, including exposed exterior cabinet members, top edges of drawer boxes, adjustable shelves, and interior panels.

2.6 SOLID SURFACING

A. Solid Surfacing Sheet: Solid surfacing sheet and plastic resin castings complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous and non-porous; no surface coating; color and pattern consistent throughout thickness.

1. Manufacturers: Subject to compliance with requirements, provide products as indicated in Color Codes on Drawings. Substitutions not permitted.
2. Colors, Patterns, and Finishes: As indicated in Color Codes on Drawings.

2.7 MISCELLANEOUS MATERIALS

A. Support Faming, Grounds, and Concealed Blocking: Comply with Section 06 1000 - Rough Carpentry.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Solid Surfacing Joint Adhesive: Manufacturer’s standard one or two-part adhesive for inconspicuous, non-porous joints.

E. Adhesive for Bonding Plastic Laminate: Product recommended by fabricator for application.

1. Adhesive for Bonding Edges (edgebanding): Hot-melt adhesive.

F. Installation Adhesives: Products recommended by fabricator for each substrate for secure anchorage.

2.8 CABINET HARDWARE AND OTHER ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Cabinet Hardware, General: BHMA A156.9, types as indicated for quality grade specified.

1. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated. Unless otherwise indicated, provide the following finish:

a. Satin Chrome: BHMA 626.

2. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

C. Butt Hinges: 5-knuckle butt hinge, overlay type, Grade 1, with hospital tip and non-removable pin. 0.095 inch thick, minimum. Stainless steel.

1. Provide two hinges for doors less than 48 inches high and provide three hinges for doors more than 48 inches high.
2. Provide four hinges for tall cabinet doors.

D. Drawer Slides: ANSI/BHMA A156.9, Type B05091.

1. General:

a. Grade 1: Self-closing, side mounted and extending under bottom edge of drawer.

1) Type: Full extension.
2) Material: Zinc-plated steel with polymer rollers.

b. Grade 1HD-100 and Grade 1HD-200: under mounted; full-extension type; zinc-plated-steel ball-bearing slides.

2. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
3. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1, HD-100.
4. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1, HD-200.

E. Back-Mounted Pulls: Back mounted, solid metal, wire pulls, 4 inches wide.

1. Available Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Hafele America Co.; Item No. 117.50.610, Wire Handle, Matt Stainless Steel: www.hafele.com.

2. Provide at wall cabinets and tall cabinets.

F. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.

1. Available Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Hafele America Co.; Model 246.26.702: www.hafele.com.
b. Stanley; SP46

G. Elbow Catches for Inactive Leaf of Pairs of Doors: ANSI/BHMA A156.9, B33023.

1. Available Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Ives No. 2: www.iveshinges.com.

H. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

I. Cabinet Locks: Keyed locks, cam or bolt type, pin tumbler, steel or brass material.

1. Complying with ANSI/BHMA A156.11, Grade 1
2. Provide on all doors and drawers.
3. Locks within a room or location shall be keyed alike and different than adjacent rooms and locations.
4. All locks on the Project shall be master keyed.
5. Provide 2 keys for each room or location and three 3 master keys.

J. Shelf Rests - Pin Type: ANSI/BHMA A156.9, B04013; metal. Standard side-mounted system using multiple drilled holes in cabinet sides for pin supported shelf rests, satin chrome finish, for nominal 1 inch spacing adjustments

K. Grommets for Cable Passage: 2-inch OD, unless otherwise indicated, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: Black.
2. Available Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Doug Mockett & Company Inc.; TG Series: www.mockett.com.

L. Aluminum Channels and Angles: 6061-T6 extruded aluminum channels, with sharp corners, mill finish, size as required or indicated on Drawings.

M. Countertop Support Brackets:

1. Exposed Tee-Shaped Brackets: Fabricated from 6063-T6 extruded aluminum tees, 2 by 2 by 1/4 inch thick.

a. Finish: Black.
b. Size: 18 by 18 inches unless otherwise indicated.
c. Maximum Weight: 450lbs per bracket.
d. Basis of Design: Subject to compliance with requirements, provide Rangine Corp.; Rakks EH Series, Surface-mounted Counter Support Bracket: www.rakks.com, or a comparable product by one of the following:

1) A&M Hardware, Inc.; www.aandmhardware.com.

2.9 FABRICATION, GENERAL

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

1. Ease edges to radius indicated for the following:

a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
b. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
3. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.

a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

D. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal cut edges.

1. Locate openings accurately and use templates to produce accurately sized and shaped openings

E. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
2. Cap exposed plastic laminate finish edges with material of same finish and pattern, unless otherwise indicated.

F. Cabinets and Millwork:

1. Assembly: Shop assemble cabinets and millwork for delivery to site in units easily handled and to permit passage through building openings.
2. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

G. Countertops:

1. Fabricate tops in one piece, unless size dictates multiple pieces.

H. Plastic laminate panels below countertops:

1. Fabricate panels in one piece, unless size dictates multiple pieces.

2.10 PLASTIC LAMINATE CABINETS AND MILLWORK

A. Architectural Woodwork Standards Grade: Premium.

1. Comply with AWS Section 10 - Casework and Section 6 - Millwork.

B. Casework Construction Type: Frameless.

C. Door and Drawer Style: Flush Overlay.

D. Cabinet Construction: As required by referenced quality standard, but not less than the following:

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard.
2. Shelves: 3/4-inch-thick particleboard.

    a. Exception: Use 1-inch-thick material at shelves more than 36 inches wide.

3. Backs of Casework: 1/2-inch-thick particleboard or MDF where exposed, 1/4-inch veneer-core hardwood plywood dadoed into sides, bottoms, and tops where not exposed.
4. Drawer Fronts: 3/4 inch thick, with particleboard or MDF cores. Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
5. Drawer Sides and Backs: 1/2-inch-thick solid-wood or veneer-core hardwood plywood, with glued dovetail or multiple-dowel joints.
6. Drawer Bottoms: 1/4-inch-thick hardwood plywood glued and dadoed into front, back, and sides of drawers.

    a. Exception: Use 1/2-inch material for drawers more than 24 inches wide.

7. Doors 48 Inches High or Less: 3/4 inch thick, with particleboard or MDF cores.
8. Doors More Than 48 Inches High: 1-1/8 inches thick, with particleboard cores.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

F. Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS (0.047 inch thick).
2. Vertical Surfaces: Grade VGS (0.028 inch thick).
3. Door and Drawer Edges: PVC edge banding, 0.118 inch (3mm) thick, matching laminate in color, pattern, and finish.
4. Other Edges: PVC edge banding, 0.039 inch (1mm) thick, matching laminate in color, pattern, and finish
5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Semi-exposed Surfaces:

1. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.

    a. Colors and Patterns: Same as exposed face.

2. All other semiexposed surfaces: Grade CLS, unless otherwise indicated.
3. Edges of Laminate Shelves: PVC edge banding, 0.039 inch (1mm) thick, matching laminate in color, pattern, and finish.

H. Concealed Surfaces:

1. Concealed Backs of Panels with Exposed or Semi-exposed Surfaces: Grade BKL (0.020 inch thick).

I. All cabinets and millwork shall be fabricated with balance construction.

J. Cabinet and millwork sizes, layouts, and configurations: As indicated on Drawings.

2.11 COUNTERTOPS

A. Quality Standard: Premium Grade, in accordance with AWS, unless noted otherwise.

1. Comply with AWS Section 11 – Countertops.

B. Solid Surface Countertops: Solid surfacing over continuous substrate.

1. Flat Sheet Thickness: 1/2 inch, minimum.
2. Substrate/Subtops: Particle board, medium density fiberboard (MDF) or plywood.

a. Thickness: 3/4 inch.
b. Provide preservative treatment for subtops at sink or other wet locations.

3. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; eased square edge; use marine edge at sinks.
4. Back and End Splashes: Same sheet material, eased square top; minimum 4 inches high.

a. Field applied.

5. Fabricate in accordance with manufacturer's standard requirements.

2.12 PLASTIC LAMINATE PANELS BELOW COUNTERTOPS

A. General:

1. Removable plastic laminate access panels below toilet room countertops/sinks where concealed tee-shaped vanity brackets are used.

B. Architectural Woodwork Standards Grade: Premium.

1. Comply with AWS Section 8 – Wall/Ceiling Surfacing and Partitions.

C. Performance Requirements:

1. Fire-Retardant-Treated Paneling: Provide panels consisting of fire-retardant cores. Panels shall have flame-spread index of 25 or less and smoke-developed index of 450 or less per ASTM E 84.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

E. Panel Construction:

1. Design: Flat panel.
2. Corner Profile in Elevation: Square; unless otherwise indicated on Drawings.
3. Panel Thickness: 3/4 inch.
4. Panel Sizes: As indicated on Drawings.
5. Panel Faces: HPDL Grade VGS (0.028 inch thick).
6. Panel Backs: HPDL Grade BKL (0.020 inch thick).
7. Panel Edges: Same as face.
8. Core: Particle board or medium density fiberboard (MDF); fire-retardant.

F. Mounting Method: Z-clips.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion.

1. Shim as required with concealed shims.
2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. Fill nail holes with matching filler where exposed.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

F. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.

G. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

H. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.

1. Secure with countersunk, concealed fasteners and blind nailing.
2. Use fine finishing nails for exposed fastening, countersunk and filled flush with interior architectural woodwork.
3. For shop-finished items, use filler matching finish of items being installed.

I. Cabinets and Millwork:

1. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

    a. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
    b. Install cabinets without distortion so doors and drawers fit openings 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.
    c. Maintain veneer sequence matching of cabinets with transparent finish.

d. Fasten cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

J. Countertops:

1. General:

a. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
b. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1) Seal edges of cutouts in plastic laminate countertops and solid surfacing subtops by saturating with varnish.

c. Apply sealant to gaps at walls with mildew-resistant silicone sealant; comply with Section 07 9200 "Joint Sealants."

2. Solid surfacing countertops:

a. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
b. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
c. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1) Install metal splines in kerfs in countertop edges at joints where recommended by manufacturer or installer. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2) Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned, and joints are of specified width.

d. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

K. Plastic Laminate Panels Below Countertops:

1. Using z-clips, install removable plastic laminate access panels below toilet room countertops where concealed tee-shaped vanity brackets are installed.

3.3 REPAIR

A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.

B. Where not possible to repair, replace defective woodwork.

3.4 CLEANING

A. Clean interior architectural woodwork on exposed and semiexposed surfaces.

END OF SECTION 06 4023

SECTION 07 5300 – EPDM MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Ethylene-propylene-diene-monomer (EPDM) roofing assembly; fully adhered. Including, but not limited to, the following:

    a. Cover board.
    b. Insulation, flat and tapered.

2. Cutting, patching, and repairs to an existing ethylene-propylene-diene-monomer (EPDM) roofing assembly.

    a. Existing roofing assembly is currently under warranty.

1.3 ABBREVIATIONS

A. EPDM: Ethylene-propylene-diene-monomer.

1.4 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.5 PREINSTALLATION MEETINGS

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

1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, roofing Installer, roofing assembly manufacturer's representative and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing assembly.
7. Review temporary protection requirements for roofing assembly during and after installation.
8. Review roof observation and repair procedures after roofing installation.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For insulation and roof assembly component fasteners, include copy of FM Approvals' RoofNav listing.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation, thickness, and slopes.
5. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Wind Uplift Resistance Submittal: For roofing assembly, indicating compliance with wind uplift performance requirements.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing assembly complies with requirements specified in "Performance Requirements" Article.

a. Submit evidence of complying with performance requirements.

C. Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

D. Field quality-control reports.

E. Sample Warranties: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

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

B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience, and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing assembly manufacturer. Protect stored liquid material from direct sunlight.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.11 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing assembly to be installed according to manufacturer's written instructions and warranty requirements.

1.12 WARRANTY

A. Existing Warranty: Modifications to existing roofing assembly:

1. Submit written verification signed by existing roof membrane manufacturer stating that the existing roof warranty has not been affected by Work performed under this Section.

B. Special Installer’s Project Warranty: Submit roofing Installer's warranty, signed by Installer, covering the Work of this Section, including all components of roofing assembly such as roof membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:

1. Warranty Period: Two years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain components for roofing assembly from one roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.2 ROOFING ASSEMBLY - GENERAL

A. Design intent is to cut, patch, and repair existing roofing as needed, matching the materials and installation methods used in the initial installation and maintaining any current roofing assembly warranties.

1. Field verify the exact materials and installation methods used.

2.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing assembly and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings shall remain watertight.

1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the Resistance to Foot Traffic Test in FM Approvals 4470.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Completed roofing shall contain no wrinkles of such size as to restrict roof drainage.

D. Comply with Factory Mutual (FM) Global and FM Approvals' RoofNav Listing requirements as follows:

1. Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals FM 4450 or FM Approvals FM 4470 as part of a roofing assembly, and shall be listed in

FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

a. Fire/Windstorm Classification: Class 1A-90.
b. Hail-Resistance Rating: SH.

2. Comply with the following Property Loss Prevention Data Sheets:

a. Data Sheet FM DS 1-28: Wind Design.
b. Data Sheet FM DS 1-29: Roof Deck Securement and Above-Deck Roof Components.
c. Data Sheet FM DS 1-49: Perimeter Flashing.

E. Minimum Insulation Requirements: Match existing number of layers, thicknesses, and R-values:

2.4 ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

A. EPDM Sheet: ASTM D4637/D4637M, Type I or Type II to match existing, EPDM sheet.

1. Thickness: To match existing; 60 mils, nominal, unless field verification indicates otherwise.
2. Exposed Face Color: Black.

2.5 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing assembly manufacturer for intended use and compatible with other roofing components.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.

C. Bonding Adhesives: Manufacturer's standard.

D. Seaming Material: Factory-applied seam tape, width as recommended by manufacturer.

E. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

G. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing assembly manufacturer.

I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.6 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM roof membrane manufacturer.

B. Match existing roof insulation; field verify the following is used in the existing roofing assembly:

1. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, glass-fiber mat facer on both major surfaces.

a. Compressive Strength: 20 psi.
b. Long Term Thermal Resistance (LTTR) R-value: At 1 inch thick; 5.7 at 75 degrees F.
c. Size: 48 by 48 inches or 48 by 96 inches.
d. Thickness: To match existing.

1) For tapered board: Slope as indicated; minimum thickness 1/2 inch.

e. Products: Subject to compliance with requirements, provide the following:
1) Carlisle SynTec Systems; InsulBase: www.carlislesyntec.com.
2) Holcim/Elevate (formerly Firestone Building Products); ISO 95+: www.holcimelevate.com.
3) Johns Manville; Enrgy 3:www.jm.com.

2.7 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing assembly components.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing assembly manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer. Provide one of the following types:

1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
2. Full-spread, spray-applied, low-rise, two-component urethane adhesive.

2.8 COVER BOARD

A. Provide one of the following types:

1. High compressive strength polyisocyanurate cover board.
2. Glass-mat, water-resistant gypsum board

B. Provide one of the following types if any exist in the current roofing assembly; field verify:

1. High compressive strength polyisocyanurate cover board.
2. Glass-mat, water-resistant gypsum board

C. Cover Board: High compressive strength polyisocyanurate cover board, ASTM C1289 Type II, Class 4, Grade 1, 1/2-inch-thick polyisocyanurate, with a minimum compressive strength of 80 psi. Glass-fiber mat facer on both major surfaces.

1. Size: 48 by 48 inches or 48 by 96 inches.
2. Thickness: 1/2 inch.
3. Insulation Thermal Resistance, R-value: 2.5, nominal.
4. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle SynTec Systems; SecurShield HD Plus: www. carlislesyntec. com.
b. Holcim/Elevate (formerly Firestone Building Products); ISOGARD HD Cover Board: www.holcimelevate.com.
c. Johns Manville; Invinsa Roof Board: www. jm. com.

D. Cover Board: ASTM C1177, glass-mat, water-resistant gypsum board.

1. Thickness: 1/2 inch.
2. Surface Finish: Factory primed.
3. Products: Subject to compliance with requirements, provide one of the following:

a. Georgia-Pacific Gypsum: DensDeck Prime Roof Board: www.gp.com.
b. National Gypsum Company; DEXcell Brand FA Glass Mat Roof Board: www.nationalgypsum.com.
a. United States Gypsum Co.; USG Securock Brand UltraLight Coated Glass-Mat Roof Board; www.usg.com.

E. Adhesive: Cover board and insulation manufacturer's recommended adhesive formulated to attach cover board to roof insulation. Provide one of the following types:

1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
2. Full-spread, spray-applied, low-rise, two-component urethane adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

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

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing assembly installation according to roofing assembly manufacturer's written instructions. Remove sharp projections.

B. 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 INSTALLATION OF ROOFING, GENERAL

A. Install roofing assembly according to roofing assembly manufacturer's written instructions and FM Approvals' RoofNav assembly requirements.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing assembly at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roof membrane and auxiliary materials to tie-in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing assembly.

3.4 INSTALLATION OF INSULATION

A. Coordinate installing roofing assembly components, so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing assembly and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Base Layer of Insulation:

a. Install base layer of insulation as follows:

1) For 48 by 48 inch boards: With joints staggered not less 24 inches in adjacent rows
2) For 48 by 96 inch boards: With end joints staggered not less than 12 inches in adjacent rows and with long joints continuous at right angle to flutes of decking.

b. Locate end joints over crests of decking.
c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

1) Trim insulation so that water flow is unrestricted.

f. Fill gaps exceeding 1/4 inch with insulation.
g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
h. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.

1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

a. Install upper insulation layers as follows:

1) For 48 by 48 inch boards: Staggered end joints within each layer not less than 24 inches in adjacent rows.
2) For 48 by 96 inch boards: Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.

b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding 1/4 inch with insulation.
f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

g. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification, as follows:

1) Use one of the following methods:

a) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
b) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification, as follows:

a. Use one of the following methods:

1) Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
2) Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Adhere roof membrane over area to receive roofing according to roofing assembly manufacturer's written instructions.

B. Unroll membrane roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing assembly manufacturer's technical personnel.

D. Accurately align roof membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. Apply roof membrane with side laps shingled with slope of roof deck where possible.

G. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.

H. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

I. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.7 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing assembly manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 FIELD QUALITY CONTROL

A. Require site attendance of roof assembly manufacturer daily during installation of the Work.

B. Final Roof Inspection: Arrange for roof assembly manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

C. Repair or remove and replace components of roofing assembly where inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements

3.9 PROTECTING AND CLEANING

A. Protect roofing assembly from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing assembly, inspect roofing assembly for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing assembly that does not comply with requirements, repair substrates, and repair or reinstall roofing assembly to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 5300

SECTION 07 8413 - FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Firestopping of penetrations.
2. Firestopping of joints.

B. Section includes firestopping of joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on Drawings or not, and other openings, joints, and construction indicated.

1.3 DEFINITIONS

A. SFRM: Sprayed fire-resistive materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration and joint 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 firestopping system, submit illustration, with modifications marked, approved by firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

a. Obtain approval of authorities having jurisdiction prior to submittal.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Product Test Reports: For each penetration and joint firestopping system, for tests performed by a qualified testing agency.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section; with not less than five years of documented experience.

B. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements"; with minimum five years of documented experience.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration and joint firestopping systems when ambient or substrate temperatures are outside limits permitted by firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration and joint firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.10 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

C. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

D. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

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

    a. Penetration and 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 Approval in its "Approval Guide."

2.2 MANUFACTURERS

A. Firestopping Manufacturers: Subject to compliance with requirements, provide products from one of the following:

1. 3M Fire Protection Systems; www.3m.com.
2. A/D Fire Protection Systems; www.adfire.com.
3. Hilti Firestop; www.hilti.com.

4. RectorSeal Firestop; www.rectorseal.com.
5. Specified Technologies, Inc. (STI); www.stifirestop.com.
6. Tremco Fire Protection Systems; www.tremcofirestop.com.

2.3 FIRESTOPPING SYSTEMS - GENERAL

A. Provide firestopping assemblies indicated, or, if not indicated, as required to comply with fire ratings indicated.

B. Fire Ratings: As indicated on Drawings.

C. Joint Firestopping:

1. Nominal Widths: As indicated on Drawings.
2. Movement Capabilities: Class 1, 50 percent compression or extension, unless otherwise indicated or required.

2.4 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls and Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated

a. At least one hour at horizontal assemblies.

2. Where indicated or required, provide the following:

a. 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.

1) Required at horizontal assemblies,

b. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

C. Penetrations in Smoke Barriers and Partitions: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.

2.5 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.

1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
2. Where indicated or required, provide the following:

a. T-Rating: At least one hour, but not less than the fire-resistance rating of adjacent construction.
b. W-Rating: Provide firestopping systems showing no evidence of water leakage when tested according to UL 1479.

C. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

2.6 ACCESSORIES

A. General: For each firestopping system, provide all primers, forming/damming/backing materials, collars, sleeves, and related materials for a complete installation

B. Penetration Firestopping Systems: 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.

C. Joint Firestopping Systems: Provide components of joint firestopping 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.

2.7 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.8 MIXING

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration and joint firestopping systems, clean out joints and openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of joints substrates and opening substrates and from penetrating items foreign materials that could interfere with adhesion of firestopping materials or compromise fire-resistive rating.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
4. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration and joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Penetrations:

a. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
b. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

2. Joints:

a. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
b. 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.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

a. In occupied areas without ceilings do not apply labels.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

C. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches 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 - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."

2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Where deficiencies are found or penetration and joint firestopping system is damaged or removed because of testing, repair or replace firestopping system to comply with requirements.

C. Proceed with enclosing penetration and joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings and joints as the Work progresses by methods and with cleaning materials that are approved in writing by firestopping system manufacturers and that do not damage materials in which openings and joint occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration and joint 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 and joint firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 8413

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:

1. Silicone joint sealants.
2. Latex joint sealants.
3. Joint backings and accessories.

1.3 ACTION SUBMITTALS

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

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency, installer, and manufacturer.

B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least 5 years of documented experience.

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

1.6 FIELD CONDITIONS

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

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with installation, performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and manufacturing requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

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

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range, unless otherwise indicated.

2.2 PERFORMANCE REQUIREMENTS

A. Provide exterior joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

2.3 SILICONE JOINT SEALANTS

A. Silicone, Nonstaining – JS1:

1. ASTM C920, Type S, Grade NS, Class 50; Uses NT, A, G, M and O.

2. Non-Staining: No staining of substrates when tested according to ASTM C1248.
3. Cure Type: Single-component, neutral-curing.
4. Hardness Range: Comply with one of the following:

    a. 15 to 35, Shore A, when tested in accordance with ASTM C661.
    b. 25 to 35, Shore A, when tested in accordance with ASTM D2240.

5. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; Dowsil 756 SMS Building Sealant: www.dow.com.
    b. Momentive Performance Materials, Inc./GE; SCS9000 SilPruf NB: www.siliconeforbuilding.com.
    c. Pecora Corporation; 890NST: www.pecora.com.
    d. Sika Corporation; Sikasil WS-295 FPS: www.usa.sika.com.
    e. Tremco, Inc.; Spectrem 3: www.tremcosealants.com.

B. Silicone, Traffic Grade – JS2:

1. ASTM C920, Type S, Grade NS, Class 100/50; Uses T, M, and O.
2. Cure Type: Single-component, neutral-curing.
3. Hardness Range: Comply with one of the following:

    a. 5 to 15, Shore A, when tested in accordance with ASTM C661.
    b. 50 to 85, Shore 00, when tested in accordance with ASTM D2240.

4. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning; Dowsil NS Parking Structure Sealant: www.dow.com.
    b. Pecora Corporation; 311NS: www.pecora.com.
    c. Sika Corporation; Sikasil - 728 NS: www.usa.sika.com.
    d. Tremco, Inc.; Spectrem 800: www.tremcosealants.com.

C. Silicone, Mildew-Resistant – JS4:

1. ASTM C920, Type S, Grade NS, Class 25; Uses NT, A, G, and O.
2. Mildew-Resistant: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
3. Cure Type: Single-component, acetoxy or neutral-curing.
4. Hardness Range: Comply with one of the following:

    a. 15 to 35, Shore A, when tested in accordance with ASTM C661.
    b. 25 to 35, Shore A, when tested in accordance with ASTM D2240.

5. Color: Clear.
6. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning; Dowsil 786 Sealant M: www.dow.com.
    b. Momentive Performance Materials, Inc./GE; SCS1700 Sanitary: www.siliconeforbuilding.com.
    c. Pecora Corporation; 898NST: www.pecora.com.
    d. Sika Corporation; Sikasil - GP: www.usa.sika.com.
    e. Tremco, Inc.; Tremsil 200 with fungicide: www.tremcosealants.com.

2.4 LATEX JOINT SEALANTS

A. Acrylic Latex – JS5:

1. Acrylic latex or siliconized acrylic latex
2. ASTM C834, Type OP, Grade NF or Minus 18 Degrees C (0 Degrees F).
3. Products: Subject to compliance with requirements, provide one of the following:

    a. Bostik, Inc.; PWC; www.bostik.com.
    b. Franklin International Inc; Titebond Painter's Plus Caulk: www.titebond.com.
    c. Pecora Corporation; AC-20 +Silicone: www.pecora.com.
    d. Sherwin Williams; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
    e. Tremco, Inc.; Tremflex 834: www.tremcosealants.com.

B. Acrylic Latex, Acoustical Sealant – JS6:

1. Nonsag, paintable, nonstaining latex sealant. Reduces airborne sound transmission through perimeter joints and openings in wall assemblies.
2. ASTM C834
3. Products: Subject to compliance with requirements, provide one of the following:

    a. Franklin International Inc; Titebond GreenChoice Professional Acoustical Smoke & Sound Sealant: www.titebond.com.
    b. PPG Architectural Coatings; Liquid Nails AS-825 Acoustical Sound Sealant: www.liquidnails.com.
    c. Pecora Corporation; AC-20 FTR: www.pecora.com.
    d. Pecora Corporation; AIS-919: www.pecora.com.
    e. United States Gypsum Co.; USG Sheetrock Brand Firecode Smoke-Sound Sealant: www.usg.com.
    f. United States Gypsum Co.; USG Sheetrock Brand Acoustical Sealant: www.usg.com.

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.

B. Cylindrical Sealant Backings (Backer Rod): ASTM C1330, Type C (closed-cell material with a surface skin) or Type B (bicellular material with a surface skin) as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

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

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include, but are not limited to, the following:

    a. Concrete.
    b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include, but are not limited to, the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.

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

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

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

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Cast-in-place Concrete:

1. Defer joint filling until concrete has aged at least one month(s).
2. Do not fill joints until construction traffic has permanently ceased.

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

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

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

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

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

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated or recommended by sealant manufacturer.

    a. Use masking tape to protect surfaces adjacent to tooled joints.

3.4 CLEANING

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

3.5 PROTECTION

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

3.6 JOINT-SEALANT SCHEDULE

A. Horizontal Traffic Surfaces:

1. Interior Joints:

    a. Joint Sealant: Silicone, Traffic-Grade – JS2.

B. Vertical and Horizontal Nontraffic Surfaces:

1. Interior Joints:

a. Latex Joint Sealant: Acrylic Latex – JS5.

1) Joint Locations: All locations except as follows:

a) Tile joints; refer to Section 09 3000 Tiling, for nontraffic tile sealant.
b) Locations where silicone, nonstaining sealants are specified.
c) Locations where mildew-resistant silicone sealants are specified.
d) Locations where acoustic sealants are specified.

b. Silicone Joint Sealant: Silicone, Nonstaining – JS1.

1) Joint Locations:

a) Perimeter joints at exterior door frames.
b) Other joints as indicated on Drawings.

c. Mildew-Resistant Joint Sealant: : Silicone, Mildew-Resistant – JS4

1) Joint Locations:

a) Joints between plumbing fixtures and adjoining walls, floors, and counters.
b) Joints between countertops and walls
c) Other joints as indicated on Drawings.

d. Acoustical Joint Sealant: Acrylic Latex, Acoustical Sealant – JS6

1) Joint Locations:

a) Gypsum board assemblies; refer to Section 09 2900 Gypsum Board.
b) Acoustical panel ceilings; ; refer to Section 09 5113 Acoustical Panel Ceilings.
c) Other joints as indicated on Drawings.

END OF SECTION 07 9200

SECTION 08 1113 – HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Hollow metal frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.4 COORDINATION

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

B. Coordinate requirements for installation of door hardware.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings and finishes.

B. Shop Drawings: Include the following:

1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
2. Locations of reinforcement and preparations for hardware.
3. Details of each different wall opening condition.
4. Details of anchorages, joints, field splices, and connections.
5. Details of accessories.
6. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly, fire-rated borrowed-lite assembly, and thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

C. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

1.8 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door, an Assa Abloy Group company: www.cecodoor.com.
2. Curries, an Assa Abloy Group company: www.curries.com.
3. Pioneer Industries, an Assa Abloy Group company: www.pioneerindustries.com.
4. Republic Doors, an Allegion brand: www.republicdoor.com.
5. Steelcraft, an Allegion brand: www.allegion.com.

2.2 PERFORMANCE REQUIREMENTS

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

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653, Commercial Steel (CS), Type B.

D. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

E. Filler: Two-component, non-shrinking resin, autobody filler.

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. 3M/Bondo; Professional Gold Body Filler: www.bondo.com.

2.4 INTERIOR STANDARD STEEL FRAMES

A. Construct hollow-metal frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Where indicated on Drawings interior doors and frames shall comply with performance requirements of Fire-Rated Door Assemblies.

C. Heavy-Duty Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

1. Locations: Provide heavy duty frames at all locations except where extra heavy duty frames are required.
2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (16 gage).
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Full profile welded.

3. Exposed Finish: Prime.

D. Extra-Heavy-Duty Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Locations: Provide extra heavy duty frames at the following locations:

a. Toilet rooms.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (16 gage).
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of flowable underlayment.

D. Material: ASTM A879, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008 or ASTM A1011; hot-dip galvanized according to ASTM A153, Class B.

2.6 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. Install hollow-metal frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames according to NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.
4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

3.4 REPAIR

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

END OF SECTION 08 1113

SECTION 08 1416 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Flush wood doors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Factory-machining criteria.
5. Factory- finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
4. Dimensions and locations of blocking for hardware attachment.
5. Dimensions and locations of mortises and holes for hardware.
6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Doors to be factory finished and application requirements.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

    a. Include corner sections of doors, with door faces and edges representing actual materials to be used.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Delamination of veneer.
    b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eggers Industries, acquired by VT Industries, Inc. : www.eggersindustries.com.
2. Graham Wood Doors; Masonite Architectural: www.graham-maiman.masonite.com.
3. Marshfield-Algoma, Masonite Architectural: https://architectural.masonite.com.
4. Mohawk Doors, Masonite Architectural: https://architectural.masonite.com.
5. Oshkosh Door Company: www.oshkoshdoor.com.
6. VT Industries, Inc: www.vtindustries.com.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards" or ANSI/WDMA I.S. 1A.

1. Where the Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

1. Performance Grade: Comply with the following:

a. Architectural Woodwork Standards Grade: Premium.
b. ANSI/WDMA I.S. 1A Heavy Duty; Premium grade.

1) Exception: Provide Extra Heavy Duty at public toilets and patient rooms.

2. Faces: Single-ply wood veneer not less than 1/50 inch thick.

a. Species: Match existing.
b. Cut: Match existing.
c. Match between Veneer Leaves: Match existing.
d. Assembly of Veneer Leaves on Door Faces: Match existing.
e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
f. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet or more.

3. Exposed Vertical and Top Edges: Applied wood edges of same species as faces and covering edges of crossbands - Architectural Woodwork Standards edge Type D.

a. Vertical Edge Bevel: Hinged edge square, and lock edge beveled 1/8 inch in 2 inches.
b. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
c. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

d. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

4. Core for Non-Fire-Rated Doors:

a. ANSI A208.1, Grade LD-2 particleboard.

1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware and as follows:

a) 5-inch top-rail blocking, in doors indicated to have closers.
b) 5-inch bottom-rail blocking, in indicated to have protection plates.
c) 5-inch midrail blocking, in doors indicated to have exit devices.

5. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware and as follows:

1) 5-inch top-rail blocking.
2) 5-inch bottom-rail blocking, in doors indicated to have protection plates.
3) 5-inch midrail blocking, in doors indicated to have exit devices or armor plates.

6. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 LIGHT FRAMES

A. Beads shall accommodate required glazing thicknesses; coordinate with Section 08 8000 – Glazing.

B. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 8000 – Glazing.

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors with transparent finishes.

C. Transparent Finish:

1. Architectural Woodwork Standards or ANSI/WDMA I.S. 1A Grade: Premium.
2. Provide one of the following systems:

a. Conversion Varnish: Architectural Woodwork Standards System-5, Varnish, Conversion or ANSI/WDMA I.S. 1A TR-4 Conversion Varnish
b. UV Cured Acrylated Epoxy, Polyester or Urethane: Architectural Woodwork Standards System-9, UV Curable, Acrylated Epoxy, Polyester or Urethane or ANSI/WDMA I.S. 1A TR-8 UV Cured Acrylated Polyester/Urethane.
c. UV Cured, Water Based: Architectural Woodwork Standards System-10, UV Curable, Water Based.
d. Catalyzed Polyurethane: Architectural Woodwork Standards System-11, Polyurethane, Catalyzed or ANSI/WDMA I.S. 1A TR-6 Catalyzed Polyurethane.

3. Staining: Match existing.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 7100 - Door Hardware.

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install fire-rated doors in accordance with NFPA 80 requirements.

D. Install smoke and draft control doors in accordance with NFPA 105 requirements.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 1416

SECTION 08 3113 – ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Access doors and frames.

1.3 DEFINITIONS

A. Non-Wet Areas: Areas not defined as wet areas; including, but not limited to, the following:

1. Toilet rooms.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For access doors and frames.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

1.6 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acudor; www.acudor.com.
2. Babcock-Davis; www.babcockdavis.com.
3. JL Industries/Activar Construction Products Group, Inc; www.activarcpg.com/jl-industries.
4. Karp Associates, Inc; www.karpinc.com.
5. Larsen's Manufacturing Company: www.larsenmfg.com.
6. Milcor / Hart & Cooley Inc; www.milcorinc.com.
7. MIFAB, Inc.; www.mifab.com.
8. Nystrom; www.nystrom.com.

2.2 MATERIALS

A. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879, with cold-rolled steel sheet substrate complying with ASTM A1008, Commercial Steel (CS), exposed.

B. Metallic-Coated Steel Sheet: ASTM A653, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

C. Frame Anchors: Same material as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153 or ASTM F2329.

2.3 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges:

1. Locations: Gypsum board.
2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Door Size: As indicated on Drawings; otherwise provide in size as required for proper access of items behind access door.
4. Door Material:

    a. Dry Areas:

        1) Uncoated Steel Sheet for Door: Nominal 0.060 inch (16 gage), factory primed.

5. Frame Material: Same material and thickness as door.
6. Hardware:

    a. Hinge: Concealed, spring type.
    b. Latch and Lock: Cam latch, screwdriver operated.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view 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 mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

E. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.5 FINISHES

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

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports.

C. Ensure that flush panel door faces align with adjacent finish surfaces.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 3113

SECTION 08 5619 – PASS WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sliding transaction window.

1.3 ACTION SUBMITTALS

A. Product Data: Provide general construction, material descriptions, finishes, dimensions and details.

B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, and installation details.

1. Include plans, elevations, sections, details, and attachments to other Work.

C. Selection Samples: Where colors and finishes are not specified, submit 3 sets of color and finish selection charts or chips.

1. Include Samples of hardware and accessories involving color selection.

D. Samples for Verification:

1. Submit 3 samples of each finish, 4 by 4 inch in size, minimum; illustrating color, finish, and texture.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Operation Data: Include normal operation, troubleshooting, and adjusting.

C. Maintenance Data: Include data on regular cleaning.

D. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least 5 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package specified products as required to prevent damage before installation.

1.7 WARRANTY

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

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal wear.

2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SLIDING TRANSACTION WINDOW

A. Product – Basis of Design:

1. Ready Access, Inc.; 275 Single Panel Slider Series.

B. Transaction Window: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, anchorage, and attachment devices.

1. Dimensions: As indicated on Drawings

a. Frame Depth: 4 inches.

2. Operable Sash: Horizontal sliding.

a. Opening Size: As indicated on Drawings.
b. Operation: Manual open; self-closing. Self-latching.

1) Adjustable to manual open; manual close.

c. Operation: As indicated on Drawings.

3. Hardware: Manufacturer's standard hardware.

a. Black Delrin handle with stainless steel mounting bracket and spring-loaded mounting base.

C. Materials:

1. Aluminum: Extruded aluminum, ASTM B221, Alloy 6063-T6 and T52 as standard with window manufacturer.
2. Glass: 1/4 inch clear tempered glass; ASTM C1048.

2.2 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. 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.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. Finish: Finish all aluminum frames and exposed aluminum on FRP doors as follows:

1. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

a. Color: Dark Bronze.

2.3 ACCESSORIES

A. Mounting Hardware: Provide all related fasteners and hardware required for a complete installation at substrates indicated.

B. Miscellaneous Trim and Accessories: Provide all trim and accessories required for a complete installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

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

3.2 INSTALLATION

A. Install specified products in accordance with manufacturer's instructions.

B. Install specified products in locations indicated.

C. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING

A. Adjust operable elements for smooth operation.

3.4 CLEANING

A. Clean specified products in accordance with manufacturer's instructions.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

3.5 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

1. Briefly describe function, operation, and maintenance of each component.

3.6 PROTECTION

A. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

B. Protect installed products from subsequent construction operations.

1. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 08 5619

SECTION 08 7100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hardware for doors specified in “Hardware Sets”.

B. Related Divisions:

1. Division 03 Concrete
2. Division 06 Rough & Finish Carpentry
3. Division 07 Joint Sealants
4. Division 08 Openings
5. Division 09 Finishes
6. Division 10 Specialties
7. Division 13 Special Construction
8. Division 26 Electrical
9. Division 27 Communications
10. Division 28 Electronic Safety and Security

1.2 REFERENCES

A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI):

1. ANSI/BHMA A156.1 Butts & Hinges (2016)
2. ANSI/BHMA A156.3 Exit Devices (2020)
3. ANSI/BHMA A156.4 Door Controls – Closers (2019)
4. ANSI/BHMA A156.6 Architectural Door Trim (2015)
5. ANSI/BHMA A156.7 Template Hinge Dimensions (2016)
6. ANSI/BHMA A156.13 Mortise Locks & Latches (2017)
7. ANSI/BHMA A156.18 Materials & Finishes (2020)
8. ANSI/BHMA A156.21 Thresholds (2019)
9. ANSI/BHMA A156.22 Door Gasketing Systems (2017)
10. ANSI/BHMA A156.25 Electrified Locks (2018)
11. ANSI/BHMA A156.26 Continuous Hinges (2017)
12. ANSI/BHMA A156.28 Keying Systems (2018)
13. ANSI/BHMA A156.29 Exit Locks and Alarms (2017)
14. ANSI/BHMA A156.30 High-Security Cylinders (2020)
15. ANSI/BHMA A156.31 Electric Strikes (2019)
16. ANSI/BHMA A156.32 Integrated Door Assemblies (2014)
17. ANSI/BHMA A156.33 Internally Powered Architectural Hardware Devices (2019)
18. ANSI/BHMA A156.35 Power Supplies for Electronic Access Control (2020)
19. ANSI/BHMA A156.36 Auxiliary Locks (2020)

B. International Code Council/American National Standards Institute (ICC/ANSI)/ADA:

1. ICC/ANSI A117.1 Standards for Accessible and Usable Buildings and Facilities.

C. Door and Hardware Institute (DHI):

1. DHI Publication – Abbreviations and Symbols (2019).
2. DHI Publication – Installation Guide for Doors and Hardware (2020).
3. DHI Publication – Sequence and Format of Hardware Schedule (2019).

D. National Fire Protection Agency (NFPA):

1. NFPA 70 National Electrical Code.

2. NFPA 80 Standard for Fire Doors and Other Opening Protectives.
3. NFPA 105 Standard for the Installation of Smoke Door Assemblies.

1.3 SUBMITTALS

A. Submit in accordance with Conditions of the Contract and Division 01 Administrative Requirements and Submittal Procedures Section.

B. Shop Drawings:

1. Schedule hardware in vertical format using the DHI publication Sequence and Formatting for the Hardware Schedule.
2. Include abbreviations and symbols page to include manufacturers' abbreviations, finish code descriptions, and fastener abbreviations including descriptions according to the DHI publication Abbreviations and Symbols.
3. Detail headings referencing the Architect's heading, opening number, locations, fire rating, handing, degree of opening, and description of the opening elements. Include Voltage, amperage, and operational descriptions for openings that have electrified hardware.
4. Coordinate final door hardware schedule with doors, frames, and related work listing proper sizing of hardware, addressing door thickness, handing, function, mounting accessories, and finish of hardware.
5. List related door devices specified in other Sections for each opening.
6. Architectural Hardware Consultant (AHC), as certified by DHI, who will affix seal attesting to completeness and correctness, including the review of the hardware schedule prior to submittal.

C. Product Data:

1. Furnish manufacturers' catalog sheets on design, grade, and function of items listed in hardware schedule. Submit only relevant information and circle or highlight the technical information including: model numbers, sizing information, voltage and amperage requirements, options and accessories required, means of fastening, listings of fire-rated applications, and finishes.

D. Templates:

1. Within fourteen days of receiving approved door hardware submittals submit complete list of templates for each hardware item to the opening manufacturers and the installers. Include detailed lists of the hardware location requirements for mortised and surface applied hardware.

E. Wiring Diagrams: Detail a title block for each drawing that includes the project name, project address, architect name, architect's opening number, hardware set, date, and name of the author.

1. Elevation Riser Drawings:

a. Furnish one set of elevation drawings with each hardware schedule submittal for hardware sets that contain electrified hardware. Illustrate the openings with proportional representations of the opening and electrified hardware components and dimension their mounting locations as well as sizes of junction boxes and power supplies. Label the components, wire quantities and gauges, high voltage requirements, as well as other building interfaces. Create a legend that complements the drawings with brand names, model numbers, and include voltage and amperage requirements. Add an operational description that includes the normal state of the door, ingress, egress, and what happens in case of power loss or fire alarm activation and any special conditions.
b. Upon receipt of approved hardware correct and resubmit elevation drawings with the point-to-point and system drawings.

2. Point-to-Point and System Drawings: Upon receipt of approved hardware schedule, submit point-to-point per hardware set and a system drawing. Cross-reference all wiring diagrams and the associated drawings to each other.

    a. Point-to-Point Drawings: Draw each product in a realistic representation including each terminal including those not used, and lines representing wires from component to component, labeling wire colors and gauges.
    b. System Drawing: illustrate all equipment and building interfaces required for the entire system. Include room labels and locations, opening numbers and locations.

F. Closeout Submittals: Include the following information as well as highlight and flag fire rated openings for annual inspections:

1. Cover page with required information:

    a. Project name
    b. Hardware supplier's name and contact information.
    c. Date of substantial completion.

2. Final record hardware schedule.
3. Product Data.
4. Keying Schedule.
5. Record Wiring Diagrams.

    a. System Drawing.
    b. Elevations.
    c. Point-to-Point Drawings with all final wire colors noted as terminated. (Include network IP and/or MAC addresses of field devices).

6. Operating and Maintenance Manual.
7. Warranty Information.
8. Maintenance service agreement(s).

1.4 QUALITY ASSURANCE

A. Hardware supplier shall employ an Architectural Hardware Consultant (AHC) as certified by DHI and a member of the seal program who will be available at reasonable times during course of work for Project hardware consultation.

1. Electrified Door Hardware Supplier Qualifications: Experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that is indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
2. Access and Electrified Security Supplier Qualifications: Experienced supplier who has completed projects with access and electrified security door hardware similar in material, design, and extent to that is indicated for this Project, whose work has resulted in construction with a record of successful in-service performance and be a factory authorized distributor.
3. Access and Electrified Security Supplier Qualifications: The supplier/integrator must be a current experienced factory authorized HASP 3 certified supplier/integrator who has completed projects with HS4 access and electrified security door hardware 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.

B. Where openings are required to be accessible door hardware shall conform to ICC/ANSI A117.1.

C. Fire Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware complying with NFPA 80 that are listed and/or labeled by a qualified testing agency for fire-protection ratings indicated.

D. Smoke and Draft Control Door Assemblies: Where smoke and draft control doors are required, provide door hardware that meets requirements of assemblies in compliance with NFPA 105.

E. Door hardware certified to ANSI/BHMA standards as noted, manufacturer must participate and be listed in BHMA Certified Products Directory.

F. Substitution requests shall be submitted in compliance with Division 01: create a comparison chart that includes the testing information as well as the warranty for both the specified product and the proposed substitution. Include the reason for requesting the substitution, clear catalog copy highlighting the proposed product and options, compliance statement, technical data, product warranty and lead time, to show how the proposed can meet or exceed established level of design, function, and quality.

G. Meetings: Comply with requirements in Division 01 Section “Project Meetings.”

1. Low-voltage Coordination Meeting

a. Prior to furnishing door hardware submittals, convene a low-voltage coordination meeting. Meeting participants should include all affected trades including the following, but not limited to: Contractor, installer, supplier, electrical contractor, security consultant and installer, Owner’s IT representative, and fire alarm consultant.
b. Review sequence of operation for each opening with electrified hardware to ensure that every opening functions properly for the Owner’s use.
c. Discuss the types of electrified door hardware, inspection, and electrical roughing-in and other preparatory work performed by other trades.
d. Verify wire quantities, wire types, wire sizes, conduit sizes, and locations including if the power supplies will be centrally located or if they will be located near each opening.
e. Coordinate the door hardware, power supplies, back-up power requirements, access control components, fire alarm interfaces, elevator controls, and related building systems have all proper and necessary components to interface and operate correctly.

2. Keying Meeting

a. Within fourteen days of receiving approved door hardware submittals, contact Owner to establish a keying conference. Include keying meeting decisions into final keying schedule submittal after reviewing the following, but not limited to:

1) Function of the building, flow of traffic, individual area’s purpose, and degree of security.
2) Lock functions and operation.
3) Preliminary key system schematic diagram.
4) Verify existing keyway(s), and/or proposed keyway(s)
5) Visual key and cylinder identification
6) Quantity of keys required including master level keys, change keys, and keys per lock.
7) Review the key control system.
8) Determine the recipient and contact information for the delivery of keys and accessories.

3. Pre-installation Meeting

a. Convene meeting within fourteen days of receiving approved door hardware submittals. Participants from all affected buildings trades shall attend. Minimum participants should include: Contractor, installer, material supplier, manufacturer representatives, electrical contractor, security consultant, and fire alarm consultant.
b. Inspect and discuss preparatory work performed by other trades.
c. Include in-conference decisions regarding proper installation methods and procedures for receiving and handling hardware.
d. Review all system, elevation, and point-to-point drawings to ensure that all necessary components are provided and detailed.

e. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
f. Review required testing, inspecting, and certifying procedures.

H. Installer Qualifications: Specialized in performing installation of this Section and have five years minimum documented experience.

1. Electrified Hardware Supplier Qualifications: Experienced door hardware installer who has installed projects with electrified door hardware 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.
2. Access Control and Electrified Security Installer Qualifications: Experienced installer who has completed projects with access and electrified security door hardware 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 and be a factory authorized to install and commission the system.
3. Access and Electrified Security Installer Qualifications: The supplier/integrator must be an experienced factory authorized HASP 3 certified supplier/integrator who has completed projects with HS4 access and electrified security door hardware 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. Work scope is to include all rough-in, cabling, installation, programming, commissioning, and owner training.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack each item complete with necessary parts and fasteners in manufacturer's original packaging.

B. Mark hardware that is not bulk packed with architect's opening number, hardware set number, and item number for each type of hardware. Include keyset symbols and corresponding hardware component for keyed products. Mark hardware that is bulk packed with manufacturers' part number and reference all hardware sets associated.

C. Deliver hardware to the job site according to the phasing agreed upon in the pre-installation meeting. Inventory the delivery with the supplier's assistance. Immediately note shortages and damages on the shipping receipts and bill of ladings. Coordinate replacement or repair with the supplier.

D. Deliver permanent keys, cores, access control credentials, software, and related accessories directly to Owner via registered mail or overnight package service. Establish the instructions for delivery to Owner at "Keying Conference."

E. Provide a clean, dry, and secure room for hardware delivered. Shelve hardware off the floor and with larger items of hardware stored on pallets. Arrange locksets and keyed cylinders by opening number. Organize the balance of hardware by brand, model of hardware, and hardware set number. Leave the door markings of the hardware visible for installers.

F. Waste Management and Disposal: Separate waste materials for use or recycling in accordance with Division 01.

1.6 WARRANTY

A. General Warranty: Comply Division 01 for Warranty requirements.

B. Special Warranty: Warranties specified in this article will not deprive Owner of other rights.

1. Ten years for manual door closers.
2. Five years for mortise, auxiliary and bored locks.
3. Five years for exit devices.
4. One year for electromechanical door hardware.

5. All access and electrified security equipment and systems will be warranted for a period of one (1) year commencing with the filing date of the Notice of Completion, provided the system has been inspected and signed off by a factory authorized installer and the factory authorized commissioning agent.

1.7 MAINTENANCE

A. Maintenance Tool and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner’s continued adjustment, maintenance, removal, and replacement of door hardware.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Produce hardware units of basic metal and forming method using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified within this specification section for applicable hardware units for finish designations indicated.

B. Fasteners:

1. Furnish screws for installation with each hardware item. Use only fasteners that are furnished by the hardware manufacturer to meet the manufacturer’s templating requirements, warranty and NFPA 80 requirements.
2. Provide Phillips-head screws except as otherwise indicated.
3. Finish exposed screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
4. Use machine screws with lead expansion shields at hardware mounting to masonry walls and floors.
5. Wood screw with plastic anchors at drywall applications without reinforcement and wood screws at applications with reinforcements.
6. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners.

    a. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely.
    b. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex nut fasteners.

7. At exterior openings furnish stainless-steel fasteners for exposed fasteners, for example thresholds and screw-applied weatherstripping.

2.2 CONVENTIONAL HINGES

A. Hinges, electric hinges, and self-closing hinges of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Products to be certified and listed by the following:

1. Butts and Hinges: ANSI/BHMA A156.1.
2. Template Hinge Dimensions: ANSI/BHMA A156.7.
3. Self-Closing Hinges: ANSI/BHMA A156.17.

C. Butt Hinges:

1. Hinge weight and size unless otherwise indicated in hardware sets:

   a. Doors up to 36” wide and up to 1-3/4” thick provide hinges with a minimum thickness of .134” and a minimum of 4-1/2” in height.
   b. Doors over 36” wide up to 48” wide and up to 1-3/4” thick provide hinges with a minimum thickness of .145” and a minimum of 5” in height.
   c. Doors greater than 1-3/4” thick provide hinges with a minimum thickness of .190” and a minimum of 5” in height.
   d. Width of hinge is to be minimum required to clear surrounding trim.
   e. Doors considered to be low to medium frequency use would require standard weight hinges and medium to high frequency use would require heavy weight hinges.

2. Base material unless otherwise indicated in hardware sets:

   a. Exterior Doors: 304 Stainless Steel, Brass or Bronze material.
   b. Interior Doors: Steel material.
   c. Fire Rated Doors: Steel or 304 Stainless Steel materials.
   d. Stainless Steel ball bearing hinges to have stainless steel ball bearings. Steel ball bearings are unacceptable.

3. Quantity of hinges per door unless otherwise stated in hardware sets:

   a. Doors up to 60” in height provide 2 hinges.
   b. Doors 60” up to 90” in height provide 3 hinges.
   c. Doors 90” up to 120” in height provide 4 hinges.
   d. Doors over 120” in height add 1 additional hinge per each additional 30” in height or fraction thereof.
   e. Dutch doors provide 4 hinges up to 120” in height and 1 additional per each additional 30” in height or fraction thereof.

4. Hinge design and options unless otherwise indicated in hardware sets:

   a. Hinges are to be of a square corner five-knuckle design, flat button tips and have ball bearings unless otherwise indicated in hardware sets.
   b. Out-swinging lockable and access-controlled doors are required to have Non-Removable Pins (NRP) to prevent removal of pin while door is in closed position.
   c. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.

D. Acceptable Manufacturers:

1. Hager Companies
2. Owner Approved Equal

2.3 ALUMINUM GEARED CONTINUOUS HINGES

A. Continuous hinges of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Products to be certified and listed by ANSI/BHMA A156.26 Grade 1.

C. Determine final model numbers and accessories required using the following criteria:

1. Door inset in relation to the frame face.
2. Door thickness and weight.

3. At fire rated openings provide hinges that carry a UL certification, up to and including 90-minute applications for wood doors and up to 3-hour applications for metal doors and provide studs as required by the manufacturer's listings.
4. Provide heavy-duty hinges for high frequency and exterior applications.
5. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
6. Size length of hinge to equal the actual door height unless otherwise stated in hardware sets.

D. Material and Design:

1. Base material: Anodized aluminum manufactured from 6063-T6 material; unexposed working metal surfaces be coated with TFE dry lubricant.
2. Bearings:

   a. Continuous hinges are to have a minimum spacing between bearings of 2-9/16". Typical door from 80" to 84" in height to have a minimum of 32 bearings.

3. Options:

   a. Provide factory-cut preparations for concealed electric power transfers.

E. Acceptable Manufacturers:

1. Hager Companies
2. Owner Approved Equal

2.4 POWER TRANSFER

A. Power transfer of one manufacturer as listed for continuity of design and consideration of warranty.

B. Products to be certified and listed by the following:

1. UL Listed Miscellaneous Fire Door Accessories.
2. UL 10C Listed for up to 3 hours on fire-rated doors and frames.
3. Classified according to Uniform Building Code (UBC) Standard 7-2, Fire Test of Door Assemblies (1997).

C. Design:

1. Stainless steel tubular wire transfer and cast housing with steel back boxes to provide weather and tamper resistance when door is open or closed.
2. Mortise door and frame installation
3. Two 18 ga wires, 5 amps @ 12/24 VAC/DC.

D. Acceptable Manufacturers:

1. Hager Companies
2. Owner Approved Equal

2.5 FLUSH BOLTS AND COORDINATORS

A. Flush bolts of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be listed by the following: Auxiliary Hardware: ANSI/BHMI A156.16.

C. Labeled openings: Provide automatic or constant latching flush bolts per hardware schedule for inactive leaf of pairs of doors. Provide dust proof strikes for bottom bolt.

D. Non-Labeled openings: Provide two flush bolts for inactive leaf of pairs of doors per hardware schedule. Provide extension rods so that the center line of the top flush bolt is not more than 78" above the finish floor. Provide dust proof strike from bottom bolt.

E. Acceptable Manufacturers:

1. Hager Companies
2. Burns Manufacturing
3. Trimco

F. Coordinators: Provide for labeled pairs of doors with automatic flush bolts or with vertical rod exit device with a mortise-locking device per hardware schedule. Provide filler piece to extend full width of stop on frame. Provide mounting brackets for closers and special preparation for latches where applicable.

G. Acceptable Manufacturers:

1. Hager Companies
2. Burns Manufacturing
3. Trimco

2.6 REMOVABLE MULLIONS

A. Keyed and non-keyed removable mullions of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be listed by the following: UL/cUL/Warnock Hersey for fire-rated pairs of doors up to 8 feet tall x 8 feet wide opening.

C. Material and Design:

1. For use with rim exit devices on non-rated and fire rated pairs of doors. Mullion 2" x 3" x 11 gage steel tube.
2. Top Fitting:

a. Mullion locked in place without use of a key.
b. Deadlock on fire-rated device

D. Acceptable manufacturers for keyed and non-keyed removable mullions:

1. Hager Companies
2. Owner Approved Equal

2.7 HEAVY DUTY MORTISE LOCKS AND LATCHES

A. Locks and latches of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Product to be certified and listed by following:

1. ANSI/BHMA A156.13 Series 1000 Certified to Grade 1 for Operational and Security.
2. UL/cUL Labeled and listed up to 3 hours for single doors up to 48" in width and up to 96" in height.
3. UL10C/UBC 7-2 Positive Pressure Rated.
4. ICC/ANSI A117.1.

C. Lock and latch function numbers and descriptions of manufacturer's series as listed in hardware sets.

D. Material and Design:

1. Lock cases from fully wrapped, 12-gauge steel, zinc dichromate for corrosion resistance.
2. Non-handed, field reversible without opening lock case.
3. Break-away spindles to prevent unlocking during forced entry or vandalism.
4. Levers, zinc cast, forged brass or stainless steel and plated to match finish designation in hardware sets.
5. Escutcheons, of solid brass or stainless-steel material.
6. Armor fronts, self-adjusting to accommodate a square edge door or a standard 1/8” beveled edge door.

E. Latch and Strike:

1. Stainless steel latch bolt with minimum of 3/4” throw and deadlocking for keyed and exterior functions.
2. Strike is to fit a standard ANSI A115 prep measuring 1-1/4” x 4-7/8” with proper lip length to protect surrounding trim.
3. Deadbolts to be 1-3/4” total length with a minimum of a 1” throw and 3/4” internal engagement when fully extended and made of stainless-steel material.

F. Options:

1. Doors required lead line protection – provide locks with 1-16” lead applied to outside case of lock.
2. Provide knurled levers on entry side of doors that are potentially dangerous to visually impaired persons.

G. Electrified Locks

1. Fail-Safe (power lock): Outside trim is locked when power is applied and unlocked when power is removed. Lockset will unlock in the event of a power failure (EL).
2. Fail-Secure (power unlock): Outside trim is locked when there is no power and unlocked when power is applied. Lockset will be locked in the event of a power failure (EU).
3. Request to Exit: Monitors inside lever rotation (RX).

H. Acceptable Manufacturers:

1. Hager Companies
2. Owner Approved Equal

2.8 WIRE-FREE AND WIRELESS WIDEBODY MORTISE LOCKS:

A. Basis of design: Where indicated in the schedule of materials provide access and security locks and latches that are from one manufacturer continuity of design and consideration of warranty.

B. Standards: Product to be certified and listed by the following standards:

1. Mortise Locks: ANSI/BHMA A156.13 certified Grade 1.
2. UL/cUL Labeled and listed for single doors up to 48” in width and up to 96” in height.
3. UL10C/UBC 7-2 Positive Pressure Rated.
4. ICC/ANSI A117.1.

C. Design:

1. Full Escutcheon design made from brass or stainless-steel material.
2. Lock cases from fully wrapped, 12-gauge steel, zinc dichromate for corrosion resistance and be non-handed, field reversible without opening lock case.
3. Levers to be made from brass or stainless-steel material that is plated to match finish designation in hardware sets and comply with ICC/ANSI A117.1.

4. Armor fronts, self-adjusting to accommodate a square edge door or a standard 1/8” beveled edge door.
5. Available with an optional privacy feature to prevent entry unless user has authorized override privileges.
6. Water resistance application lock units must have an option for outdoor and wet environments.
7. Internal lever will be free to operate and retract all latches/deadbolts, allowing free egress by way of a single action.
8. Optional mechanical key override.
9. Latch and Strike:

    a. Provide stainless steel latch bolt that has a dead latching feature or dead bolt.
    b. Strike is to fit a standard ANSI A115 prep measuring 1-1/4” x 4-7/8” with proper lip length to protect surrounding trim.

10. Electrical Features:

    a. Locks are to be wire-free with an option to be wireless and operated by standard alkaline batteries sufficient for up to 48,000 transactions. No proprietary or rechargeable battery packs will be accepted.
    b. Low battery status will be recorded on the user’s credential and transferred to the management system when the credential is presented at an online wall reader.
    c. In the event of a battery failure, the door will be able to be opened with a small portable handheld device in conjunction with a valid credential.
    d. Integral request to exit switch.
    e. An audit trail of the last 1,000 events will be stored on the locks memory for collection for collection using the portable handheld device at any time and without access to the inside component of the door lock.
    f. The current date and time will be synchronized with the server with a portable handheld device.
    g. Have typical access control features and be able to mimic traditional door hardware functions. The following is a minimum of the required door operational features:

        1) Office
        2) Automatic Changes
        3) Automatic Opening
        4) Automatic Opening plus Office
        5) Automatic Opening plus Toggle
        6) Times Office
        7) Timed Toggle
        8) Toggle Only

    h. Be able to be programmed to remain unlocked during certain hours and days, automatically changing to a locked down mode outside of these times i.e.- go into office, card only, card plus PIN mode, etc. Each lock will have a minimum of 8 different automatic locking and unlock schedules. This feature can be manipulated by day of the week and by system holidays for each door lock.
    i. Automatically adjust for daylight saving time. This feature will be flexible enough to provide changeable dates from year to year. This feature will not require a visit to the lock with a programming device.
    j. Length of time that can open the door after a valid credential is presented will be a variable and managed by the software, allowing for users with physical disabilities additional time when needed to access the opening.
    k. Optional Automatic Locking (lockdown mode), locks will be able to lock down from the inside in an emergency. While the lock is in lockdown mode, one designated token will be able to enter the locked down door unit. Once the unit is returned to normal programming mode, it will operate as previously programmed. Activation and resetting of the lockdown mode (AMOK) will be done with a card holders token. This privilege will be given to the desired card holder on a person-by-person basis.

l. Operation of the optional key override will be recorded in the lock unit audit trail memory to provide increased security and to track key usage.

D. Manufacturers:

1. Hager Companies HS4
2. Approved Equal

2.9 WIRE-FREE AND WIRELESS EXIT DEVICE TRIM

A. Standards: Product to be certified and listed by the following standards:

1. Exit Device Trim: ANSI/BHMA A156.3 certified Grade 1.
2. UL/cUL Labeled and listed for single doors up to 48” in width and up to 96” in height.
3. UL10C/UBC 7-2 Positive Pressure Rated.
4. ICC/ANSI A117.1.

B. Design:

1. Full Escutcheon design made from brass or stainless-steel material.
2. Levers to be made from brass or stainless-steel material that is plated to match finish designation in hardware sets and comply with ICC/ANSI A117.1.
3. Water resistance application lock units, must have an option for outdoor and wet environments.
4. Optional mechanical key override.

C. Electrical Features

1. Exit device trims are to be wire-free with an option to be wireless and operated by standard alkaline batteries sufficient for up to 48,000 transactions. No proprietary or rechargeable battery packs will be accepted.
2. Low battery status will be recorded on the user’s credential and transferred to the management system when the credential is presented at an online wall reader.
3. In the event of a battery failure, the door will be able to be opened with a small portable handheld device in conjunction with a valid credential.
4. Request to exit terminal for an external request to exit switch.
5. An audit trail of the last 1,000 events will be stored on the locks memory for collection for collection using the portable handheld device at any time and without access to the inside component of the door lock.
6. The current date and time will be synchronized with the server with a portable handheld device.
7. Have typical access control features and be able to mimic traditional door hardware functions. The following is a minimum of the required door operational features:

    a. Easy Office
    b. Automatic Changes
    c. Automatic Opening
    d. Automatic Opening plus Easy Office
    e. Automatic Opening plus Toggle
    f. Times Office
    g. Timed Toggle
    h. Toggle Only

8. Be able to be programmed to remain unlocked during certain hours and days, automatically changing to a locked down mode outside of these times i.e.- go into easy office, timed easy office, card only, etc. Each exit device trim will have a minimum of 8 different automatic locking and unlock schedules. This feature can be scheduled by day of the week and by system holidays for each door lock.
9. Automatically adjust for daylight saving time. This feature will be flexible enough to provide changeable dates from year to year. This feature will not require a visit to the lock with a programming device.

10. Length of time that can open the door after a valid credential is presented will be a variable and managed by the software, allowing for users with physical disabilities additional time when needed to access the opening.
11. Operation of the optional key override will be recorded in the lock unit audit trail memory to provide increased security and to track key usage.

D. Manufacturers:

1. Hager Companies HS4
2. Approved Equal

2.10 MORTISE DEADBOLTS

A. Mortise deadbolts of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be certified by the following:

1. ANSI/BHMA A156.13 Series 2000 Grade 1 Operational and Security.
2. UL/cUL listed for functions up to 3 hours for “A” label.
3. UL10C/UBC 7-2 Positive Pressure Rated.
4. ADA – Thumb turn.

C. Deadbolt function numbers and descriptions of manufacturer’s series as listed in hardware sets.

D. Material and Design:

1. Latch bolt projection 1” throw.
2. Case steel, zinc dichromate.
3. Armor front 5-9/16”. Case dimension 4-5/16” x 3-9/16’ x 1”.

E. Acceptable Manufacturers:

1. Hager Companies
2. Owner Approved Equal

2.11 EXIT DEVICES

A. Exit Devices of one manufacturer as listed for continuity of design and consideration of warranty. Touchpad type finish to match balance of door hardware.

B. Standards: Manufacturer to be certified and/or listed by the following:

1. BHMA Certified ANSI A156.3 Grade 1.
2. UL/cUL Listed for up to 3 hours for “A” labeled doors.
3. UL10C/UBC 7-2 Positive Pressure Rated.
4. UL10B Neutral Pressure Rated.
5. UL 305 Listed for Panic Hardware.

C. Material and Design:

1. Provide exit devices with actuators that extend a minimum of one-half of door width.
2. Where trim is indicated in hardware sets provide the lever design to match design of lock levers.
3. Exit device to mount flush with door.
4. Latch bolts:

    a. Rim device – 3/4” throw, Pullman type with automatic dead-latching, stainless steel

b. Surface vertical rod device – Top 1/2" throw, Pullman type with automatic dead-latching, stainless steel. Bottom 1/2" throw, Pullman type, held retracted during door swing, stainless steel.

5. Fasteners: Wood screws, machine screws, and thru bolts.

D. Lock and Latch Functions: Function numbers and descriptions of manufacturer's series and lever styles indicated in door hardware sets.

E. Acceptable Manufactures:

1. Hager Companies
2. Detex
3. Von Duprin

F. Electric Modifications:

1. Motorized Latch Retraction (MLR): An electric motor retracts the latch bolt for momentary or maintained periods of time.
2. Provide Request to Exit (REX) switches as scheduled.
3. Electrified Trim: Outside trim locked (EL) or unlocked (EU) by electric current.

2.12 CYLINDERS AND KEYING

A. Cylinders of one manufacturer as listed for continuity of design and consideration of warranty.

B. Products to be certified and listed by the following:

1. Auxiliary Locks: ANSI/BHMA A156.5

C. Cylinders:

1. Provide cylinders matched to the types required for hardware that has a locking function and for keyed electronic functions. Furnish with appropriate collars, cams, and tailpieces to fit and operate associated hardware. Stacking collars is not acceptable, a single collar of proper size is required.
2. Manufacturer's seven-pin small format interchangeable core (SFIC).
3. Provide concealed key control (CKC) at cylinder by stamping or permanently marking the keyset symbol in a location on the cylinder that is concealed when installed.

D. Keying:

1. Key into Owner's existing Kaba Peaks key system.
2. Provide a bitting list to Owner of combinations as established and expand to twenty-five percent for future use or as directed by Owner.

a. Include all the keysets and bittings of the original key system creating one clean version of the entire key system.

3. Keys to be shipped directly to the Owner's Representative as established during the keying conference.

a. Package the keys in individual envelopes, grouped by keyset symbol, and label envelopes with project name, factory registry number, and keyset symbol.

4. Stamp large bow key blanks with visual key control (keyset symbol) and "Do Not Duplicate".
5. Provide interchangeable cores with construction cores as required per the keying meeting.

E. Acceptable Manufacturers:

1. Kaba Peaks

2.13 AND BARS

A. Push/Pull plates and bars of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be certified by the following:

1. Architectural Door Trim: ANSI/BHMA A156.6.
2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

C. Push plates: .050" thick, square corner and beveled edges with countersunk screw holes. Width and height as stated in hardware sets.

D. Pull Plates: .050" thick, square corner and beveled edges. Width and height as stated in hardware sets, 3/4" diameter pull, with clearance of 2-1/2" from face of door.

E. Push Pull Bar Sets: 1" round bar stock with 2 –1/2" clearances from face of door. Offset 3", 90-degree standard. Center to center size should be door width less 1 stile width.

F. Pull Bar Sets: 1" round bar stock with 2 –1/2" clearances from face of door.

G. Acceptable Manufacturers:

1. Hager Companies
2. Burns Manufacturing
3. Trimco

2.14 CLOSERS

A. Closers of one manufacturer as listed for continuity of design and consideration of warranty, unless otherwise indicated on hardware schedule, comply with manufacturer's recommendations for size of closer, depending on width of door, frequency of use, atmospheric pressure, ADAAG requirement, and fire rating.

B. Standards: Manufacturer to be certified and or listed by the following:

1. BHMA Certified ANSI A156.4 Grade 1.
2. ADA Complaint ANSI A117.1.
3. UL/cUL Listed up to 3 hours.
4. UL10C Positive Pressure Rated.
5. UL10B Neutral Pressure Rated.

C. Material and Design:

1. Provide cast iron non-handed bodies with full plastic covers.
2. Closers will have separated staked adjustable valve screws for latch speed, sweep speed, and backcheck.
3. Provide Tri-Pack arms and brackets for regular arm, top jamb, and parallel arm mounting.
4. One-piece seamless steel spring tube sealed in hydraulic fluid.
5. Double heat-treated steel tempered springs.
6. Precision-machined heat-treated steel piston.
7. Triple heat-treated steel spindle.
8. Full rack and pinion operation.

D. Mounting:

1. Out-swing doors use surface parallel arm mount closers except where noted on hardware schedule.
2. In-swing doors use surface regular arm mount closers except where noted on hardware schedule.
3. Provide brackets and shoe supports for aluminum doors and frames to mount fifth screw.
4. Furnish drop plates where top rail conditions on door do not allow for mounting of closer and where backside of closer is exposed through glass.

E. Size closers in compliance with requirements for accessibility (ADAAG). Comply with following maximum opening force requirements.

1. Interior hinged openings: 5.0 lbs.
2. Fire-rated and exterior openings use minimum opening force allowable by authority having jurisdiction.

F. Fasteners: Provide self-reaming, self-tapping wood and machine screws, and sex nuts and bolts for each closer.

G. Acceptable manufacturers:

1. Hager Companies
2. Owner Approved Equal

2.15 PROTECTIVE TRIM

A. Protective trim of one manufacturer as listed for continuity of design and consideration of warranty.

B. Size of protection plate: single doors, size two inches less door width (LDW) on push side of door, and one inch less door width on pull side of door. For pairs of doors, size one inch less door width (LDW) on push side of door, and 1/2 inch on pull side of door. Adjust sizes to accommodate accompanying hardware, such as, edge guards, astragals, and others.

1. Kick Plates 10” high or sized to door bottom rail height.
2. Mop Plates 4” high.
3. Armor Plates 36” high.

C. Products to be certified and listed by the following:

1. Architectural Door Trim: ANSI/BHMA A156.6.
2. UL.

D. Material and Design:

1. 0.050” gage stainless steel.
2. Corners square, polishing lines, or dominant direction of surface pattern so they run across door width of plate.
3. Bevel top, bottom, and sides uniformly leaving no sharp edges.
4. Countersink holes for screws. Space screw holes so they are no more than eight inches CTC, along a centerline not over 1/2” in from edge around plate. End screws maximum of 0.53” from corners.

E. UL label stamp required on protection plates when top of plate is more than 16 inches above bottom of door on fire rated openings. Verify door manufacturer’s UL listing for maximum height and width of protection plate to be used.

F. Acceptable Manufacturers:

1. Hager Companies
2. Owner Approved Equal

2.16 STOPS AND HOLDERS

A. Stops and holders of one manufacturer as listed for continuity of design and consideration of warranty.

B. Wall Stops: Provide door stops wherever necessary to prevent door or hardware from striking an adjacent partition or obstruction. Provide wall stops when possible. Door stops and holders mounted in concrete floor or masonry walls have stainless steel machine screws and lead expansion shields.

C. Products to be certified and listed by the following:

1. Auxiliary Hardware: ANSI/BHMA A156.16.

D. Acceptable Manufacturers:

1. Hager Companies
2. Owner Approved Equal

E. Overhead Stops and Holders: Provide overhead stops and holders for doors that open against equipment, casework sidelights and other objects that would make wall stops/holders and floor stops/holders inappropriate. Provide sex bolt attachments for mineral core wood door applications.

F. Products to be certified and listed by the following:

1. Overhead Stops and Holders: ANSI/BHMA A156.8 Grade 1.

G. Acceptable Manufacturers:

1. Hager Companies
2. ABH
3. Owner Approved Equal

2.17 WALL READER / CONTROL UNIT

A. Basis-of-Design Product: Where indicated in the hardware sets provide wall readers/control unit that are manufactured by one manufacturer for continuity of design and consideration of warranty.

B. Wall Readers:

1. Include support for one or two wall readers and be MiFare/DESfire capable. Secure reader to wall with a vandal resistant frame and tamper proof fixings plus a control unit.
2. Have optional keypad available for keypad only or for dual credential validation.
3. Make the connection between wall reader and control unit by a UTP CAT5e or better cable.

C. Control Unit:

1. Be 12VDC and compliant to ISO 15.93 and FCC Part 15 and certified to the following standards: CE, UL 294, FCC part 15.
2. Provide Ethernet connectivity of all on-line devices via IP4 or IP6 addressing, either hardwired or through ZigBee 16 Channel WiFi Connection (802.15.4).
3. Provide the ability to use 1 IP address and connect 4 additional controllers using RS485 (10 card readers per IP address.
4. Provide the ability to support 2 readers and 2 locking devices with on board programmable relays.

5. Support a minimum of 400 foot in cable length for each card reader and support Anti-Pass back.
6. Provide encryption between the controller and each card reader.
7. Provide a minimum of 6 auxiliary inputs for use as door position, request to exit, or for any non-door purpose required. Must support a minimum of 60 inputs per IP address without the use of an auxiliary input board or device.
8. Provide for up to 16 auxiliary output boards with a total of not less than 128 outputs available for end user programming.
9. Provide the flexibility for either online wireless or offline battery-operated locks, allowing for the two system types to be integrated into the same facility.
10. Provide two on board tamper option, input, and switch.
11. Capable of integrating with the elevator management system to control access to individual floors for individual users. Connection to the CU will be via a RS485 serial connection to Extension Relay Boards (ERB) consisting of 8 NO/NC 12VDC dry contact relays. The Electronic Access Control (EAC) system will allow for up to 16 ERB to be connected in series to each control unit.
12. Connect directly to the Electronic Access Control (EAC) application and be capable of making changes to the individual user access profile when a credential is presented and at the same time pass the list of recently cancelled cards on to the key and upload any stored “on key” audits of attempts to access doors and any low battery warnings from the stand-alone locks.
13. During times of power failure: hold its designation and zones it belongs to, operational configuration, audit trail and a list of cancelled keys in non-volatile memory. Will connect directly to the EAC application and be capable of making changes to individual user access profile when credential is presented and at the same time pass a list of recent cancelled cards on to the key and upload any stored “on key” audits of attempts to access doors and any low battery warnings from the stand-alone locks.
14. Have the capability to operate both as an off-line stand-alone door controller or, be easily upgraded with additional hardware to function as an integrated part of the on-line EAC system.

D. Manufacturers:

1. Hager Companies HS4
2. Approved equal

2.18 UNDER DESK SWITCH

A. Under desk switches of one manufacturer as listed for continuity of design and consideration of warranty.

B. Design:

1. Momentary push button.
2. Mounts to the underside of a desk or counter.

C. Acceptable Manufacturers:

1. Hager Companies
2. Security Door Controls
3. Approved Equal

2.19 POWER SUPPLIES AND CONTROLLER CABINETS (10 DOOR)

A. Basis of design: Where indicated in the schedule of materials provide power supplies that are from one manufacturer continuity of design and consideration of warranty.

B. Certifications:

1. CE approved
2. UL294 Listed – Access Control System Units

C. Design:

1. 10 door Power Supply Enclosure
2. Houses (5) HS4 controllers.
3. Wall mount for indoor use
4. Removeable mounting backplane
5. Operating Temperature: 32 to 120 degrees F
6. 16AWB powder-coated steel enclosure.
7. Single 2” center knockout on top of enclosure
8. Sixteen 2-stage knockouts for .75” or 1”
9. One Cam Lock
10. One Tamper Switch

D. Technical Characteristics:

1. 120VAC input power source
2. Dual Input Power Distribution Module

    a. Steers Power from wither two low voltage AC or DC power sources
    b. 8 fused protected outputs

3. Access Power Controller 1

    a. Converts (1) 12 to 24VAC or VDC input to (4) independently controlled fuse protected outputs.
    b. Power outputs can be converted to dry form “C” contacts.
    c. Outputs operate in both fail-safe or fail secure modes.
    d. FACP interface
    e. Option for shared or separate power sources for board operation and locking devices.

4. Access Power Controller 2

    a. Converts (1) 12 to 24VAC or VDC input to (4) independently controlled fuse protected outputs.
    b. Power outputs can be converted to dry form “C” contacts.
    c. Outputs operate in both fail-safe or fail secure modes.
    d. FACP interface
    e. Option for shared or separate power sources for board operation and locking devices.

E. Manufacturers:

1. Hager Companies HS4
2. Approved Equal

2.20 THRESHOLDS

A. Thresholds of one manufacturer as listed for continuity of design and consideration of warranty.

B. Set thresholds for exterior and acoustical openings in full bed of sealant with lead expansion shields and stainless-steel machine screws complying with requirements specified in Division 07 Section “Joint Sealants: Notched in field to fit frame by hardware installer. Refer to Drawings for special details.

C. Standards: Manufacturer to be certified by the following:

1. Thresholds: ANSI/BHMA A156.21.
2. American with Disabilities Act Accessibility Guidelines (ADAAG).

D. Acceptable Manufacturers:

1. Hager Companies
2. National Guard Products
3. Pemko

2.21 DOOR GASKETING AND WEATHERSTRIP

A. Door gasketing and weatherstrip of one manufacturer as listed for continuity of design and consideration of warranty.

B. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing where indicated on hardware schedule. Provide noncorrosive fasteners for exterior applications.

1. Perimeter gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting stile gasketing: Fasten to meeting stiles, forming seal when doors are in closed position.
3. Door bottoms: Apply to bottom of door, forming seal with threshold or floor when door is in closed position.
4. Sound Gasketing: Cutting or notching for stop mounted hardware not permitted.
5. Drip Guard: Apply to exterior face of frame header. Lip length to extend 4” beyond width of door.

C. Products to be certified and listed by the following:

1. Door Gasketing and Edge Seal Systems: ANSI/BHMA A156.22.
2. BHMA certified for door sweeps, automatic door bottoms, and adhesive applied gasketing.

D. Smoke-Labeled Gasketing: Comply with NFPA 105 listed, labeled, and acceptable to Authorities Having Jurisdiction, for smoke control indicated.

1. Provide smoke-labeled gasketing on 20-minute rated doors and on smoke rated doors.

E. Fire-Rated Gasketing: Comply with NFPA 80 listed, labeled, and acceptable to Authorities Having Jurisdiction, for fire ratings indicated.

F. Refer to Section 08 1416 Wood Doors for Category A or Category B. Comply with UBC 7-2 and UL10C positive pressure where frame applied intumescent seals are required.

G. Acceptable Manufacturers:

1. Hager Companies
2. National Guard Products
3. Pemko

2.22 DOOR POSITION SWITCHES

A. Provide door position switches for openings that require door monitoring.

B. Acceptable Manufacturers:

1. Hager Companies
2. GRI
3. Security Door Controls

2.23 WIRELESS DOOR POSITION SWITCHES

A. Basis of design: Where indicated in the schedule of materials provide wireless communicating door position switches for each wireless access and security lock and exit device that are from one manufacturer continuity of design and consideration of warranty

B. Manufacturers:

1. Hager Companies HS4.
2. Approved equal

2.24 GATEWAYS AND NODES

A. Basis of design: Where indicated in the schedule of materials provide gateways and nodes for online communication with the wireless locking devices that are from one manufacturer continuity of design and consideration of warranty

B. Gateways

1. Establishes the communication link between the PC and the wireless network.
2. Managed through the ProAccess Space software.
3. Sends and collects all information through the nodes to and from the the wireless locking devices.
4. Technical Characteristics:

a. Frequency Range: 2400-2483.5 Mhz.
b. RF Standard: Bluetooth
c. Indoor Radio Range: 10/15m..
d. Maximum output power: 8dBm
e. AES 128 bit encryption
f. LAN Network connection: 10Base-T / 100Base-T
g. One internal node included.
h. Manages up to six additional nodes.
i. IP addressing through web explorer available,
j. Firmware updates vis software through an ethernet connection.
k. PoE supported IEEE802.3af
l. Optional 12VDC power adaptor
m. Cable Requirements: UTP CAT5e
n. Built in tamper switch

C. Nodes

1. Bridge between the gateway and the wireless locking devices.
2. Technical Characteristics:

a. RF Standard: Bluetooth
b. Indoor Radio Range: 10/15m.
c. BUS485 connection to the gateway.
d. AES 128 bit encryption
e. Manages up to 16 wireless locking devices.
f. Firmware updates vis software through an ethernet connection.

D. Manufacturers:

1. Hager Companies HS4.
2. Approved equal

2.25 MANAGEMENT TOOLS

A. Ncoder

1. Assigns and deletes keycards into and out of the software
2. Reads keycards
3. OTA dongle for mobile credentials

B. Technical Characteristics:

1. Communications protected by standard cryptography (DTLSv.2-AES128).
2. Built-in Ethernet and USB interfaces
3. DHCP IP Addressing
4. Standards-compliant reader/encoder with SAM data are not stored in the device.
5. Power Consumption 5V

C. Platforms:

1. SVN Data-on-card
2. JustIn Mobile Bluetooth SMART (BLE)
3. JustIn Mobile: NFC:

D. ID Technologies:

1. MiFare (DESFire EV2, Plus, Ultralight C, Classic-ISO/IEC 14443)
2. HID iCLASS
3. Bluetooth SMART (BLE)
4. NFC

E. Portable Programming Device:

1. Function:

a. Initialize wireless locking devices
b. Collect audit trail
c. Update locks
d. Diagnostics of wireless locking devices
e. Emergency opening
f. Firmware update

2. Technical Data:

a. 3-pin connection to wire-free and wireless locking devices
b. Contactless NFC connection to wire-free and wireless locking devices
c. PC connection: USB, RS232
d. Power requirements: Alkaline battery powered

F. Manufacturers:

1. Hager Companies HS4.
2. Approved equal

2.26 SILENCERS

A. Where smoke, light, or weather seal are not required, provide three silencers per single door frame, two per double door frame and four per Dutch door frame.

B. Products to be certified and listed by the following:

1. Auxiliary Hardware: ANSI/BHMA A156.16

C. Acceptable Manufacturers:

1. Hager Companies
2. Owner Approved Equal

2.27 KEY CABINET

A. Provide key cabinet; surface mounted to wall.

B. Key control system:

1. Include two sets of key tags, hooks, labels, and envelopes.
2. Contain system in metal cabinet with baked enamel finish.
3. Capacity will be able to hold actual quantities of keys, plus 50 percent.
4. Provide tools, instruction sheets, and accessories required to complete installation.

C. Acceptable Manufacturers:

1. Lund Equipment
2. Telkee Incorporated
3. Key Control

2.28 ACCESS AND SECURITY MANAGEMENT SYSTEM

A. Basis-of-Design: Subject to compliance with requirements, provide a web-based access control data-on-card software platform fully integrated that integrates all physical security requirements through networked, wired, stand-alone and battery-operated locks.

B. System requirements

1. Provide central management of users' rights, access policies and credentialing.
2. Application will be capable of implementing access policies through the assignment of entry permission based on door groupings and time schedules.
3. Allow for schedules to be applied at doors, governing their remaining open or locked condition.
4. Allow for creation and editing of cardholder credentials, including system wide card formats.
5. Permit flexible assignment of user rights and privileges.
6. Provide views of events and alarms throughout the installation and be capable of triggering hardware and communicative actions-based system configuration.
7. Capable of generating standard and custom reports and provide a detailed log of all system events as defined by the system operator.
8. Capable of real time door access monitoring with on-line capability.
9. System will support a combination of wireless (wire–free) and online (hardwired) wall readers to secure perimeter doors as well as battery powered electronic locks to secure all interior doors, manufactured in the and supported by the same manufacturer.
10. Read/write capability is mandatory; any system that does not use a two-way encrypted Smart Card (RFID) communication format will be considered unacceptable.
11. Card readers and electronic locks shell be compatible with a wide range of smart card (RFID) Technologies, operating on the industry standard frequency of 13.56MHz.

    a. HID iClass: Memory capacity: 32K bit with 2 application area configurations. The HID-IClass credential will have a minimum of 16 kb, 32kb preferred of available memory and allow the possibility for use with multiple vendors across multiple applications.
    b. MIFARE: 4k Bytes
    c. DESFire: 4k Bytes

d. DESfire EVI: 4k Bytes
e. Sony FeliCa: 4k Bytes
f. Legic: 4k Bytes
g. Pico Pass: 4k Bytes
h. BLE: Blue Tooth Low Energy
i. NFC: Near Field Communication at 13.56MHz

C. Software

1. Incorporate 128-bit AES encrypted data.
2. Supported operating systems will be Microsoft Windows, Windows 7 SP1, Windows 8.1, 10, Windows Server 2008 R2 or Server 2012 R2, 2016. Both 32-bit and 64-bit versions.
3. Support a web-based interface as part of the same software package. Loading or licenses for a separate application or having to download software will be unacceptable: acceptable browsers are Internet Explorer, Firefox, Chrome, and Safari.
4. Database engine will be SQL Server 2005, 2008 R2, 2012, 2014, 2016, 2017 and LocalDB. All editions support ”Express” included.
5. Operating temperature of 0°C to 50°C, ambient, a storage temperature of -40°C to +85°C, ambient, a relative humidity ability of 0% to 95% (non-condensing) at 50°C, and a MTBF of > 100,000 hours.
6. The system-radiated emissions will be compliant with FCC Part 15, Class A, and EN55022 specifications.
7. The system must be capable of managing 4 million users, 64,000 doors, 256 calendars, 1024 zones, and 256 time zones, 1024 time periods, both with 8 intervals each.
8. Support integration with other software systems through dynamic database synchronization.
9. Be able to store all historical data on the system server without having to individually use a handheld device to download audit trail data from individual locks.
10. Be capable of being expanded throughout the site. Support database partitioning such that each area (department) will be able to manage their own doors and users without a chance of accidentally interfering with other areas (departments).
11. Capable of dynamic master-keying: each credential can change access privileges transparently “on the fly” without the need to visit the access control administrator to reprogram keycards and without the need to reprogram the electronic locks with a handheld programmer.
12. No predefined profiles will be necessary to issue keycards. Each keycard can be individually enabled to access any combination of doors.
13. Lost keycard cancellation: Contactless smart cards be capable of conveying lists of cancelled keys to avoid having to reprogram locks with a handheld device any time a keycard is lost.
14. No third-party WI-FI or Radio infrastructure will be required for Operation.
15. The software will be supplied ready to support any number and configuration of off-line and on-line stand-alone locks and wall readers, with the capacity to manage multiple or single sites.
16. A Portable Programming Device (PPD) for transferring information to and from the database for all off-line locks and wall readers will also be included.
17. Operator Groups will be defined hierarchically and be password protected to allow only authorized staff to make amendments to sections of the database for which they have responsibility.
18. Have a proven Application Programming Interface (API) for interfacing with existing and well-established traditional access control systems.
19. Support an “Out of Site” feature which will work in conjunction with IN and OUT on-line readers to disable user access when leaving a facility and enabling user access when entering it.
20. Support a “Limited User Access” feature which can be set to allow a maximum number of users assigned to a door.
21. Support a “Limited User Occupancy” monitor which can be set to disallow access after the desired number is reached in an area.
22. Support setting encryption type for DESfire cards.
23. Incorporate an activation date and time setting for user cards.
24. Allow multiple operator groups to be created with software features able to be individually allowed or denied to the group.
25. The system software will support the following optional features:

    a. Visitor Management
    b. Badging
    c. Partitions

d. Third party access system interface
e. Software to software API with other wired access control systems
f. Graphical mapping

26. As a standard feature in all software versions, database import and export utilizing “flat files” will be supported.
27. In the event of an emergency the System Administrator will have the ability to either lock down or unlock all or some doors/locks connected via the Salto Wireless Network (SVN). These doors will then remain locked or unlocked until the emergency is designated as over by the System Administrator.
28. Synchronize the server clock with the on-line CU approximately every 30 seconds.

D. Manufacturer:

1. Hager Companies HS4 ProAccess Space
2. Approved Equal

2.29 HS4 CREDENTIALS

A. Basis-of-Design: Provide a secured contactless smartcard technology that provides high-speed, reliable communication with data integrity.

B. Technology

1. 13.56 MHz Smart Credentials
2. AES 128-bit encryption
3. Reusable, contactless RFID smart credentials in the available in the following:

a. MiFare 1K
b. MiFare 4K
c. DESfire 4K
d. Dual Technology (MiFare and mag stripe)
e. JustIn Mobile
f. NFC Mobile

4. Access profile for the individual user, encoded on the card, be encrypted and in such a format as to negate the potential for cloning.
5. Standard 16 kb or 32kb preferred memory on each credential is required to be secured with a unique set of Keys- A&B for the Electronic Access Control (EAC) system and capable of being enabled when required via the collection and transfer of information but not limited to audit trails, lost and stolen cards.
6. Credentials will be available in multiple form factors. They include but are not limited to the following: standard ID card format, printable ID card format, key fob format, wristwatch format, rubber wrist band format, RFID stickers, BLE mobile and NFC tokens. All devices are required to work at the same level.
7. Reusable, contactless RFID smart credentials in the available in the following technologies:

a. MiFare 1K
b. MiFare 4K
c. DESfire 4K
d. Dual Technology (MiFare and mag stripe)

C. Manufacturers:

1. Hager Companies HS4
2. Approved Equal

2.30 FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if within 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 range of approved samples.

B. Comply with base material and finish requirements indicated by ANSI/BHMA A156.18 designations in hardware schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with installers present, for compliance with requirements for installation tolerances, labeled fire-rated construction, wall and floor construction, and other conditions affecting performance.

B. Where hardware will be installed directly on walls inspect applications for blocking material of sufficient type and size for hardware.

C. Examine roughing-in and cabling for electrical power systems to verify actual locations of wiring connections and wiring supplied matches the requirements as described in the wiring diagrams before electrified door hardware installation.

D. Perform a site survey to determine proper mounting locations for all wirelessly communicating devices. Verify that the surrounding construction and equipment will not interfere with the communication between components.

E. Where existing products will be reused, examine existing door and frame sizes, preps, swings, ratings, and compare to the specified hardware for compatibility and functionality. The hardware set specified should act as guide for design and function. Provide filler plates as needed to fill and repair existing materials. Test any existing to remain hardware for functionality and visually inspect for damage. Note any defective or damaged products as well as noting any code deficiencies and submit issues and estimated costs for direction of how to proceed with repair or replacement.

F. Notify Architect via a prepared written report and endorsed by installer of any discrepancies between the door schedule, door types, drawings, and scheduled hardware. List conditions detrimental to application, to the proper and timely completion of the work and performance of the hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 INSTALLATION

A. Install hardware using manufacturers' recommended fasteners and installation instructions, at height locations and clearance tolerances that comply with:

1. NFPA 80
2. NFPA 105
3. ICC/ANSI A117.1
4. DHI Publication – Installation Guide for Doors and Hardware
5. Approved shop drawings
6. Approved hardware schedule

B. Install soffit mounted gaskets prior to other soffit mounted hardware ensuring a continuous seal around the perimeter of the opening without cutting or notching.

C. Locate surface mounted door closers on stairwell side of stair doors, interior side of exterior openings, or on the room side of openings, unless it is a sterile room.

D. Locate wall mounted bumper to contact the operating trim. Verify that pushbuttons of locksets do not contact the stop and inadvertently lock the door.

E. Mount armor, mop, and kick plates flush with the bottom of the door and centered horizontally on the door.

F. Notch thresholds with no larger than a 1/32-inch gap matching the frame profile. Set in a full bed of sealant complying with requirements specified in Division 07 Section “Joint Sealants” forming a tight seal between threshold and mounting surface. Caulk and seal the entire perimeter to prevent water leakage. Remove excess sealants immediately and clean the area thoroughly.

G. Do not install surface mounted items until finishes have been completed on substrates involved. Set unit level, plumb and true to line location.

H. Locate power supplies and junction boxes as directed and verified in the low-voltage coordination meeting.

I. Perform final connections of the system components to match the approved operational narratives. Use cable markers to label wires at each termination or end to match the final wiring diagrams. Terminate wiring in accordance with the manufacturer’s recommendations. Where quick-connects are seated correctly. Provide wire ties and adhesive pads to secure and organize wires in enclosures. Outside of enclosures seal terminations in waterproof connectors. Include record drawings of the point-point and the elevations in a plastic sleeve attached to the inside cover of the power supply/junction box enclosure for the Owner’s use.

3.3 FIELD QUALITY CONTROL

A. Schedule a final walk through to inspect hardware installation ten (10) business days before final acceptance of the Owner. Visually inspect for proper fasteners and verify that doors open, close, latch properly, and that openings are installed to meet NFPA 80 and ANSI A117.1 requirements. Correct deficiencies, including missing hardware immediately. Provide a written report detailing discrepancies of each opening within five (5) business days of the walk through.

B. Prior to receiving certificate of occupancy have doors inspected by a Certified Fire and Egress Door Assembly Inspector (CFDAI), as certified by Intertek (ITS), submit a written report to the Owner and Contractor. Doors failing inspection must be adjusted, modified, or replaced to be within appropriate code requirements without delay.

C. Test the functionality of electrified openings upon completion of the installation in accordance with the description of operation and the Owner’s intent under the supervision of a factory authorized representative and an Owner’s representative, verify that all features of the software are working correctly, including interfaces with any associated trades. Document the result of all tests and provide these results to the Owner and correct immediately.

3.4 ADJUSTMENT, CLEANING, AND DEMONSTRATING

A. Prior to final adjustments, the HVAC system must be completed and balanced. Test that all openings meet ANSI A117.1 for closer opening pressure, closing speed, latching, and hardware operating forces. Replace items that cannot be adjusted to operate freely and smoothly or as intended for application.

B. Prior to final walk-through inspection, clean adjacent surfaces soiled by hardware installation. Clean finish hardware per manufacturer’s instructions after final adjustments have been made. Remove all protection and replace items that cannot be cleaned to manufacturer’s level of finish quality.

C. Demonstration and training will be conducted as per the following sessions. All sessions will be recorded and turned over to the Owner for future use.

1. Hardware Maintenance: Conduct a training class for building maintenance personnel demonstrating the adjustment, operation, and maintenance of mechanical and electrified hardware. Special tools for finish hardware to be turned over and demonstrated usage at the meeting.

2. Key control system: Train the Owner's designated representative on the key control system demonstrating the permanent file keys, duplicate loaner keys, key receipts, key envelopes, key change identification sheets, bitting lists, tags, and labels. When key management software is provided training will be provided for the setup and usage of the software.
3. Access control: Demonstrate the management and programming of the access control system including the following, but not limited to:

    a. System administration personnel to manage the LAN and databases including updating, maintaining, and backing up the system and database software.
    b. Instruct on all software features and programming for managing the credentials, users, access points, time zones, alarms and events, door monitoring, audit trails, and time schedules.

3.5 PROTECTION

A. Leave manufacturer's protective film intact and, protect exit devices, locks, and surface mounted hardware with kraft paper or bubble wrap. Cover fire labels at painted products that bear a label with magnetic or masking tape. Keep protection in place until time of final cleaning and adjustment.

3.6 HARDWARE SET SCHEDULE

A. Door hardware items have been placed in sets which are intended to be a guide of design, grade, quality, function, operation, and performance.

1. Review products that may require mounting accessories to meet door, frame, and swing conditions as these final details vary from manufacturer to manufacturer and provide as required.
2. Where additional items of hardware are required for completion of the Work, a written statement of such omission, error, or other discrepancy is required to be submitted to the Architect, prior to bid date for clarification via an addendum.
3. Abbreviations listed below do not appear in the manufacturer's literature, for any other abbreviations refer to manufacturer's literature.:

    a. LDW = Less than Door Width
    b. LAR = Length as Required
    c. QTY = Quantity
    d. CTC = Centerline to Centerline
    e. BTB = Back-to-Back mounting

3.7 HARDWARE SCHEDULE

Manufacturer List

Code	Name
BYOT	By Others
HA	Hager
HO	HS4

Hardware Sets

Set #01.00

Doors: H120A

1	Wide Body Mortise Lock	HE38MBBW23M	US32D	HO
1	BLUEnet Comms	SPACE-OPT-0033		HO
1	Balance of Hardware	Existing to Remain		BYOT

NOTE: Wireless Online Access Control Lock

Operation:
Door normally closed and locked.
A valid credential at the reader unlocks the outside lever for entry.
Free egress at all time.
Lockdown by the existing lockdown button
Lockdown override by an emergency credential.

Set #01.01

Doors: 106

3	Hinge(s)	BB1279 4 1/2" x 4 1/2"	US26D	HA
1	Wide Body Mortise Lock	HE38MBBW23M	US32D	HO
1	Closer(s)	5100 HD	ALM	HA
1	Kick Plate(s)	190S 10" x 2" LDW CSK	US32D	HA
1	Convex Wall Stop(s)	232W	US32D	HA
3	Silencers	307D	GREY	HA
1	BLUEnet Comms	SPACE-OPT-0033		HO

NOTE: Wireless Online Access Control Lock

Operation:
Door normally closed and locked.
A valid credential at the reader unlocks the outside lever for entry.
Free egress at all time.
Lockdown by the existing lockdown button
Lockdown override by an emergency credential.

Set #02.00

Doors: H120B

1	Wide Body Mortise Privacy	HT38MBBW23M	BLK	HO
1	Balance of Hardware	Existing to Remain		BYOT

NOTE: Wire-free Offline Access Control Lock

Operation:
Door normally closed and locked.
A valid credential at the reader unlocks the outside lever for entry.
Free egress at all time.
Local lockdown by privacy thumb turn throws the deadbolt, locks outside lever, and blocks the reader.
Lockdown override by an emergency credential.

Set #02.01

Doors: 103, 104, 107

3	Hinge(s)	BB1279 4 1/2" x 4 1/2"	US26D	HA
1	Wide Body Mortise Privacy	HT38MBBW23M	BLK	HO
1	Convex Wall Stop(s)	232W	US32D	HA
3	Silencers	307D	GREY	HA

NOTE: Wire-free Offline Access Control Lock

Operation:
Door normally closed and locked.
A valid credential at the reader unlocks the outside lever for entry.
Free egress at all time.
Local lockdown by privacy thumb turn throws the deadbolt, locks outside lever, and blocks the reader.
Lockdown override by an emergency credential.

Set #02.02

Doors: 108, 112

3	Hinge(s)	BB1279 4 1/2" x 4 1/2"	US26D	HA
1	Wide Body Mortise Privacy	HT38MBBW23M	BLK	HO
1	Closer(s)	5100	ALM	HA
1	Kick Plate(s)	190S 10" x 2" LDW CSK	US32D	HA
1	Convex Wall Stop(s)	232W	US32D	HA
3	Silencers	307D	GREY	HA

NOTE: Wire-free Offline Access Control Lock

Operation:
Door normally closed and locked.
A valid credential at the reader unlocks the outside lever for entry.
Free egress at all time.
Local lockdown by privacy thumb turn throws the deadbolt, locks outside lever, and blocks the reader.
Lockdown override by an emergency credential.

Set #02.03

Doors: 109

3	Hinge(s)	BB1279 4 1/2" x 4 1/2"	US26D	HA
1	Wide Body Mortise Privacy	HT38MBBW23M	BLK	HO
1	Closer(s)	5100	ALM	HA
1	Kick Plate(s)	190S 10" x 2" LDW CSK	US32D	HA
1	Mop Plate(s)	190S 4" x 1" LDW CSK	US32D	HA
1	Convex Wall Stop(s)	232W	US32D	HA
1	Seal	726 x LAR	B	HA

NOTE: Wire-free Offline Access Control Lock

Operation:
Door normally closed and locked.
A valid credential at the reader unlocks the outside lever for entry.
Free egress at all time.
Local lockdown by privacy thumb turn throws the deadbolt, locks outside lever, and blocks the reader.
Lockdown override by an emergency credential.

Set #03.00

Doors: 101, 110

3	Hinge(s)	BB1279 4 1/2" x 4 1/2"	US26D	HA
1	Wide Body Mortise Lock	HE38MBBW23M	US32D	HO
1	Closer(s)	5100	ALM	HA
1	Kick Plate(s)	190S 10" x 2" LDW CSK	US32D	HA
1	Convex Wall Stop(s)	232W	US32D	HA
3	Silencers	307D	GREY	HA

NOTE: Wire-free Offline Access Control Lock

Operation:
Door normally closed and locked.
A valid credential at the reader unlocks the outside lever for entry.
Free egress at all time.

Set #04.00

Doors: MISC

1	Gateway	GATEWAYW3CUS	HO
4	Construction Cards	PCM01KC00	HO

NOTE: The access control software, credentials, and peripheral management tools are already established with the Owner's existing access control system.

END OF SECTION 08 7100

SECTION 08 8000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Monolithic glazing.
2. Laminated glazing.
3. Miscellaneous glazing materials.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, primary glass manufacturer, and fabricated-glass manufacturer.

B. Product Certificates: For glass.

C. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. GANA Publications: “GANA Sealant Manual.”

B. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

C. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

D. Source Limitations for Glass:

1. Obtain clear float glass from single source from single manufacturer.
2. Obtain laminated glass and insulated glazing units from a single source from a single fabricator.

E. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

1. Each GL-Type in Glazing Schedule shall be from single source from single manufacturer unless otherwise indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS MANUFACTURERS

A. Float Glass Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Guardian Glass, LLC: www.guardianglass.com.
2. Pilkington North America Inc: www.pilkington.com.
3. Viracon, Inc: www.viracon.com.
4. Vitro Architectural Glass (formerly PPG Industries, Inc.): www.vitroglazings.com.

B. Laminated Glass Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Any of the manufacturers specified for float glass or a fabricator approved by one of the specified float glass manufacturers.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Thickness: Indicated glass thicknesses are minimums. Provide glass that complies with performance requirements and load designs, and is not less than the thickness indicated.

C. Glass Strength:

1. Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with performance requirements.
2. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with performance requirements.

D. Glass Distortion Tolerances:

1. Roller Wave: Maximum 0.003 inch from peak to valley within the main body of the sheet and maximum 0.008 inch within 10.5 inches of a leading or trailing edge.
2. Localized Warp: Maximum 0.03 inch over any 12 inch span, but limited to 0.31 inch.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

F. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated, including assembly dead loads and live loads, in accordance with local building codes and ASTM E1300.

1. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, and as indicated on Drawings.
2. Probability of Breakage for Glass Sloped:

a. Not more than 15 degrees from vertical:

1) Design glass for a probability of breakage not greater than 0.008 (8 lites per 1,000)

b. More than 15 degrees from vertical:

1) Design glass for a probability of breakage not greater than 0.001 (1 lite per 1,000).

3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 the short side length or 1 inch, whichever is less.
4. Thermal Loads (Differential Shading): Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

G. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

1. Provide permanent markings on safety-rated glazing in compliance with applicable safety glazing standards, ICC (IBC), local building code and authorities having jurisdiction.
2. Glass indicated to be fully tempered (Kind FT) glass or laminated glass shall comply with safety glazing requirements.

2.3 FLOAT GLASS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

2.4 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Float glass laminated with a polyvinyl butyral (PVB) interlayer to comply with interlayer manufacturer's written instructions.

a. Unless otherwise indicated:

1) Laminated glass shall consist of two plies of clear annealed float glass with a polyvinyl butyral interlayer.
2) Glass plies shall be of equal thicknesses.

2. Interlayer:

a. Material: Polyvinyl butyral.
b. Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.

1) Minimum Thickness: 0.060 inch thick, unless otherwise indicated.

c. Color: Clear unless otherwise indicated.

3. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air pockets.

2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. EPDM, silicone, or neoprene with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. EPDM, silicone, or neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated, but not less than 50 to 60 Shore A durometer hardness.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. EPDM, silicone, or neoprene with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

F. Glazing Gaskets and Splines: Resilient silicone, EPDM or polyvinyl chloride extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black

G. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Glazing:

1. Interior Glass: Unless otherwise indicated, all interior glass shall be non-insulated glass units.

a. Provide safety glass where indicated and as required by local building code and authorities having jurisdiction.

B. Installation Method:

1. Use one or more of the specified glazing methods as recommended by GANA, glass manufacturer, fabricator, and installer, and as required to comply with performance requirements.

C. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

D. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

E. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

F. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

G. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

H. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

I. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

J. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

K. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

L. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

M. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant as recommended by GANA.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape as recommended by GANA..

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing 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 in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances 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. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 GLAZING SCHEDULE

A. GL-1A Translucent safety glass.

1. Clear laminated safety glass.
2. Minimum Overall Thickness: 1/4 inch (6 mm).
3. Safety glazing required.

END OF SECTION 08 8000

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Non-load-bearing steel framing systems for interior partitions, ceilings, and soffits.
2. Suspension systems for interior ceilings and soffits.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Indicate component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories and items of other related work.
2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Qualification Statement.

B. Installer's Qualification Statement.

C. Evaluation Reports: For firestop tracks, post-installed anchors, and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the following:

1. ClarkDietrich Building Systems: www.clarkdietrich.com.
2. Jaimes Industries Inc.: www.jaimesind.com.
3. Marino\WARE: www.marinoware.com.
4. MBA Building Supplies, Inc.: www.mbastuds.com.
5. State Building Products; www.statebp.com.
6. The Steel Network, Inc: www.SteelNetwork.com.
7. Steel Stud Solutions, LLC; www.steelstudsolutions.com.
8. Telling Industries; www.buildstrong.com.

2.2 PERFORMANCE REQUIREMENTS

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Protective Coatings: Equivalent (EQ) coatings are not acceptable; products shall be hot-dip galvanized as indicated.

C. Embossed (equivalent thickness) steel framing products are not acceptable; products shall be in steel thicknesses indicated.

D. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

E. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

F. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.

1. Exception: Limit deflection of walls to receive hard tile surfaces to 1/360 of the wall height based on horizontal loading of 5 lbf/sq. ft.

2.3 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
2. Protective Coating: ASTM A653/A653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C645.

1. Steel Studs and Tracks:

a. Minimum Base-Steel Thickness: 0.0329 inch (20 gage).
b. Depth: As indicated on Drawings.

C. Slotted Deflection Track: Provide galvanized sheet steel track with slotted holes in flanges for mechanical anchorage of studs that accommodate deflection; provide screws and anti-friction bushings.

1. Comply with the following:

a. Provide at partition heads to structure connections, where indicated on Drawings, and elsewhere as required to accommodate axial deflection.
b. Shall prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above
c. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
d. Comply with ASTM C645 and ASTM C754.
e. Protective Coating: ASTM A653/A653M, G40, hot-dip galvanized.
f. Minimum Metal Thickness: Same material thickness as studs.
g. Track Depth: Matching studs.
h. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.

D. At Contractor's option, the following products may be used instead of traditional framing and firestopping:

1. General: Provide components UL-listed for use in head of partitions and joint systems and as indicated on drawings.
2. Slotted Deflection and Firestop Track: Galvanized sheet steel track with slotted holes in flanges for mechanical anchorage of studs that accommodate deflection; provide screws and anti-friction bushings. Includes intumescent strip factory-applied to track flanges or web that expands when exposed to heat or flames to provide a perimeter joint seal.

    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) ClarkDietrich Building Systems; BlazeFrame (DSL 2): www.clarkdietrich.com.
        2) Marino\WARE; FAS Track 1000: www.marinoware.com.

3. Firestop Track: Galvanized sheet steel track with intumescent strip factory-applied to track flanges or web that expands when exposed to heat or flames to provide a perimeter joint seal.

    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) ClarkDietrich Building Systems; BlazeFrame (DL2): www.clarkdietrich.com.

4. Preformed Top Track Firestop Seal: Pre-formed firestop device field-applied to head of top track that expands when exposed to heat or flames to provide a perimeter joint seal.

    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) Hilti, Inc; Top Track Seal CFS TTS: www.us.hilti.com.

E. Cold-Rolled Channel Bridging: 0.064 inch thick (16 gage), galvanized minimum base-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- (16 gage) thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: Galvanized steel sheet members.

1. Minimum Base-Steel Thickness: 0.0329 inch (20 gage).
2. Depth: 7/8 inch, unless otherwise indicated on Drawings.

G. Z-shaped Furring: Galvanized sheet steel z-shaped furring with slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch.

1. Minimum Metal Thickness: 0.0312 inch (20 gage).
2. Depth: 2 inches, unless otherwise required to fit insulation thickness indicated, or otherwise indicated on Drawings.

H. Resilient Furring Channels: ASTM C645; 1/2-inch-deep, galvanized steel sheet members designed to reduce sound transmission.

1. Minimum Base-Steel Thickness: 0.0179 inch (25 gage).
2. Configuration: Asymmetrical.

I. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Steel Thickness: 0.064 inch thick (16 gage), galvanized.

2.4 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Hanger Attachments to Concrete:

1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, AC193, AC58, or AC308 as appropriate for the substrate.

a. Uses: Securing hangers to structure.
b. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
c. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch (16 gage) and minimum 1/2-inch-wide flanges.
1. Depth: 2 inches, unless otherwise indicated on Drawings.

E. Furring Channels (Furring Members):

1. Hat-Shaped, Rigid Furring Channels: ASTM C645; galvanized steel sheet members.

a. Minimum Base-Steel Thickness: 0.0329 inch (20 gage).
b. Depth: 7/8 inch, unless otherwise indicated on Drawings.

2. Resilient Furring Channels: ASTM C645; 1/2-inch-deep, galvanized steel sheet members designed to reduce sound transmission.

a. Minimum Base-Steel Thickness: 0.0179 inch (25 gage).
b. Configuration: Asymmetrical.

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. At Contractor's option provide grid suspension system instead of traditional carrying and furring channels.
2. Not permitted for multi-layer gypsum board systems.
3. Manufacturers: Subject to compliance with requirements, provide one of the following products:

a. Armstrong World Industries, Inc.; Drywall Grid Suspension System: www.armstrongceilings.com.
b. CertainTeed/Saint-Gobain; Quickspan Locking Drywall Grid System: www.certainteed.com.
c. Rockfon, Part of the Rockwool Group; Chicago Metallic Drywall Grid: www.rockfon.com.
d. USG Corporation: Drywall Suspension System: www.usg.com

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

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) Williams; Everlastic EVA 200; www.williamsproducts.net.

C. Knee Wall Bracing: Reinforcing designed to support out-of-plane loading of cantilevered partial height wall systems unsupported at the top track.
1. Provide in quantities and sizes to fully brace and reinforce wall assembly; provide all related hardware and accessories.
2. Manufacturers: Subject to compliance with requirements, provide one of the following products:
a. ClarkDietrich Building Systems; Pony Wall PW Series: www.clarkdietrich.com.
b. Pittcon Industries; SKB Knee Brace Kit: www.pittconindustries.com.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing, suspension systems and other related accessories and components in accordance with manufacturer’s instructions.

C. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

D. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

E. Install bracing at terminations in assemblies.

F. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Install studs at 16 inches o.c. unless otherwise indicated or required by horizontal deflection performance requirements.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slotted Deflection Tracks: Where framing extends to overhead structural supports, install slotted deflection tracks to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 07 2100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Lateral/Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 2116

SECTION 09 2900 – GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Gypsum board.
2. Tile backing panels.
3. Finishing materials.
4. Trim accessories.
5. Acoustic insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

1. Include locations of control joints.

C. Samples: For the following products:

1. Submit three samples of each board type, 4 inches square in size
2. Trim Accessories: Submit three samples of each type of trim, full-size in 4-inch-long lengths.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Qualification Statement.

B. Installer's Qualification Statement.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

C. Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store 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.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install interior gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

D. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.

1. Exception: Limit deflection of walls to receive hard tile surfaces to 1/360 of the wall height based on horizontal loading of 5 lbf/sq. ft.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 GYPSUM BOARD

A. Gypsum Wallboard: Paper-faced gypsum panels; ASTM C1396/C1396M.

1. Thickness: 1/4 and 1/2 inch.
2. Long Edges: Tapered with paper face wrapping edge.
3. Short Edges: Square cut.
4. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Regular Gypsum Board: www.certainteed.com.

b. Continental Building Products; Regular Drywall: www.continental-bp.com.
c. Georgia-Pacific Gypsum; ToughRock Gypsum Board: www.gp.com.
d. National Gypsum Company; Gold Bond Brand Gypsum Board: www.nationalgypsum.com.
e. USG Corporation; Sheetrock Brand Gypsum Panels: www.usg.com.

B. Gypsum Board, Type X: Paper-faced gypsum panels with fire-resistant core; ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered with paper face wrapping edge.
3. Short Edges: Square cut.
4. Type: Fire resistance rated Type X, UL or WH listed.
5. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Type X Gypsum Board: www.certainteed.com.
b. Continental Building Products; Firecheck Type X: www.continental-bp.com.
c. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gp.com.
d. National Gypsum Company; Gold Bond Brand Fire-Shield Gypsum Board: www.nationalgypsum.com.
e. USG Corporation; Sheetrock Brand Firecode X Panels: www.usg.com.

C. Lightweight Gypsum Wallboard: Paper-faced lightweight gypsum panels; ASTM C1396/C1396M.

1. May be used at Contractor's option instead of regular gypsum wallboard.
2. Thickness: 1/2 inch.
3. Long Edges: Tapered with paper face wrapping edge.
4. Short Edges: Square cut.
5. Maximum Weight: 1.4 psf.
6. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Easi-Lite Lightweight Gypsum Board: www.certainteed.com.
b. Continental Building Products; Liftlite Drywall: www.continental-bp.com.
c. Georgia-Pacific Gypsum; ToughRock Lite-Weight Gypsum Board: www.gp.com.
d. National Gypsum Company; Gold Bond Brand High Strength Lite Gypsum Board: www.nationalgypsum.com.
e. USG Corporation; Sheetrock Brand UltraLight Panels: www.usg.com.

D. Lightweight Gypsum Wallboard, Type X: Paper-faced lightweight gypsum panels with fire-resistant core; ASTM C1396/C1396M.

1. May be used at Contractor's option instead of gypsum board, Type X.
2. Thickness: 5/8 inch.
3. Long Edges: Tapered with paper face wrapping edge.
4. Short Edges: Square cut.
5. Type: Fire resistance rated Type X, UL or WH listed.
6. Maximum Weight: 2 psf.
7. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Or Equal: www.certainteed.com.
b. Continental Building Products; Or Equal: www.continental-bp.com.
c. Georgia-Pacific Gypsum; ToughRock Lite-Weight Fire-Rated Gypsum Board: www.gp.com.
d. National Gypsum Company; Gold Bond Brand High Strength Fire-Shield Lite Gypsum Board: www.nationalgypsum.com.
e. USG Corporation; Sheetrock Brand UltraLight Firecode X Panels: www.usg.com.

2.4 TILE BACKING PANELS

A. Glass-Mat Backing Panel: Coated glass mat water-resistant gypsum backing panel; ASTM C1178/C1178M.

1. Thickness: 5/8 inch.
2. Type: Fire resistance rated Type X, UL or WH listed.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. Locations: Non-wet areas and elsewhere as indicated on Drawings; including, but not limited to, the following:

    a. Kitchens.
    b. Laundry areas.
    c. Locker rooms.
    d. Toilet rooms.

5. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; GlasRoc Diamondback Tile Backer: www.certainteed.com.
    b. Continental Building Products; Or Equal: www.continental-bp.com.
    c. Georgia-Pacific Gypsum; DensShield Tile Backer: www.gp.com.
    d. National Gypsum Company; Gold Bond Brand eXP Tile Backer: www.nationalgypsum.com.
    e. USG Corporation; Durock Brand Glass-Mat Tile Backerboard: www.usg.com.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead (J-shaped) or L-Bead (L-shaped) at exposed edges.
    c. Expansion (control) joint.

3. Manufacturers: Subject to compliance with requirements, available manufacturers with products that may be incorporated into the Work include, but are not limited to, the following:

    a. ClarkDietrich Building Systems: www.clarkdietrich.com.
    b. Marino\WARE: www.marinoware.com.
    c. Telling Industries; www.buildstrong.com.
    d. Phillips Manufacturing Co: www.phillipsmfg.com.
    e. USG Corporation: www.usg.com.

4. At Contractor’s option, the following products may be used instead of traditional interior trim.

    a. Interior Trim: Impact-resistant composite corner bead consisting of copolymer core, joint tape and surface paper.

        1) Shapes:

            a) Cornerbead; inside and outside corners.
            b) L-Trim.

2) Products: Subject to compliance with requirements, provide one of the following:

a) Structus Building Technologies, Inc.; No-Coat Structural Laminate Drywall Corner System; www.no-coat.com
b) CertainTeed Corp.; No-Coat Drywall Corner: www.certainteed.com

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products from one of the following

a. Fry Reglet Corp.; www.fryreglet.com.
b. Gordon, Inc.; www.gordon-inc.com.
c. Pittcon Industries; www.pittconindustries.com.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
3. Shapes and Profiles: As indicated on Drawings, including, but not limited to, the following:

a. Z-Reveals: Equal to Fry Reglet Model DRMZ-625-25.

4. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape: Paper, 2 inches wide, creased for joints and corners.

1. Exception: At tile backing panels use fiberglass tape; coated 10-by-10 glass mesh.
2. Manufacturers: Subject to compliance with requirements, provide products from one of the specified gypsum wall board manufacturers.

C. Joint Compound: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat Backing Panel: As recommended by backing panel manufacturer.

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Joint Compound: As recommended by gypsum board manufacturer.

2. Adhesives: Subject to compliance with requirements, provide one of the following

    a. Franklin International, Inc; Titebond GREENchoice Professional Drywall Adhesive; www.titebond.com.
    b. PPG Architectural Coatings; Liquid Nails DWP-24 Drywall Construction Adhesive: www.liquidnails.com.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

D. Sound-Attenuation Blankets: Produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Acoustic Insulation: Provide one of the following types:

    a. Mineral Fiber/Rock Wool Batts: ASTM C665; preformed mineral fiber, friction fit type, unfaced.

        1) Thickness: 3 inches, unless otherwise indicated.
        2) Density: 2.5 pcf.
        3) Flame Spread/Smoke Developed: 0/0 per ASTM E84.
        4) Products: Subject to compliance with requirements, provide one of the following:

            a) JohnsManville; Mineral Wool Sound Attenuation Fire Batts (SAFB): www.jm.com.
            b) Owens Corning; Thermafiber SAFB (Sound Attenuation Fire Batts): www.owenscorning.com.
            c) Rockwool; Safe'n'Sound: www.rockwool.com.

    b. Fiberglass Batts: ASTM C665; preformed glass fiber, friction fit type, unfaced.

        1) Thickness: 3-1/2 inches, unless otherwise indicated.
        2) Products: Subject to compliance with requirements, provide one of the following:

            a) CertainTeed Corporation/Saint-Gobain; NoiseReducer Sound Attenuation Batts: www.certainteed.com.
            b) Johns Manville; Formaldehyde-Free Fiberglass Insulation: www.jm.com.
            c) Knauf Insulation; EcoBatt Insulation with ECOSE Technology: www.knaufinsulation.com.
            d) Owens Corning Corporation; EcoTouch Sound Attenuation Batts: www.owenscorning.com.

E. Acoustical Sealant: Nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Reduces airborne sound transmission through perimeter joints and openings in wall assemblies.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Franklin International Inc; Titebond GreenChoice Professional Acoustical Smoke & Sound Sealant: www.titebond.com.
    b. PPG Architectural Coatings; Liquid Nails AS-825 Acoustical Sound Sealant: www.liquidnails.com.
    c. Pecora Corporation; AC-20 FTR: www.pecora.com.
    d. Pecora Corporation; AIS-919: www.pecora.com.
    e. United States Gypsum Co.; USG Sheetrock Brand Firecode Smoke-Sound Sealant: www.usg.com.
    f. United States Gypsum Co.; USG Sheetrock Brand Acoustical Sealant: www.usg.com.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840, GA-216, and manufacturer's instructions.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft.in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Glass-Mat Backing Panels: Comply with manufacturer's written installation instructions. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect. Place control joints consistent with lines of building spaces and as follows:

1. Not more than 30 feet apart on walls and ceilings, unless otherwise indicated.
2. Submit control joint locations to Architect for approval prior to installation.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead or L-Bead: Use at exposed panel edges.

D. Aluminum Trim: Install in locations indicated on Drawings and as follows:

1. Use longest practical lengths.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

a. Exception: Fire-Rated Construction shall comply with requirements of assembly listing

2. Level 2: In utility areas, behind cabinetry, and in similar locations that shall not be painted or finished, and at tile backing board to receive tile finish.
3. Level 4: At areas that will be exposed to view; unless otherwise indicated.

E. Glass-Mat Backing Panels: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

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

3.8 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board until deficiencies have been corrected.

1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.

2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:

   a. Installation of 80 percent of lighting fixtures, powered for operation.
   b. Installation, insulation, and leak and pressure testing of water piping systems.
   c. Installation of air-duct systems.
   d. Installation of air devices.
   e. Installation of mechanical system control wiring.
   f. Installation of ceiling support framing.

END OF SECTION 09 2900

SECTION 09 3000 – TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Hard tile.
2. Stone thresholds.
3. Setting materials.
4. Waterproofing and crack isolation membranes.
5. Metal trim.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Large Format Tile: Tiles that have at least one side greater than 15 inches long but are not as large as tile panels/slabs.

D. LHT: Large and heavy tile.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

1. Include:

a. TCNA installation methods.
b. Locations of waterproofing and crack isolation membranes.
c. Locations and profiles of metal trim.

C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.

a. For sheet-mounted tile, provide full size sheet.

2. Full-size units of each type of trim and accessory for each color and finish required.
3. Thresholds in 6-inch lengths for each profile, color and finish required.
4. Metal trim in 6-inch lengths for each profile, color and finish required.

E. Product Schedule: For tile. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Product Certificates: For each type of product.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience, and as follows:

1. Installer employs only Ceramic Tile Education Foundation Certified Installers.
2. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of mud floors, membranes, shower receptors, and large format tile.

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.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials from single manufacturer.
2. Obtain waterproofing and crack isolation membrane from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Thresholds.
2. Metal edge strips.

2.2 PERFORMANCE REQUIREMENTS

A. Floor tile and other traffic surfaces:

1. Dynamic Coefficient of Friction: Not less than 0.42 when tested in accordance with DCOF AcuTest per ANSI A137.1.

2.3 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation methods, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.4 TILE PRODUCTS

A. Tile: Refer to Color Codes on Drawings. Substitutions not permitted.

1. Grout Colors: As indicated by Room Finish Schedules and Color Codes on Drawings or, if not indicated, standard colors as selected by Architect.
2. Joint Sizes: As recommended by tile manufacturer unless otherwise indicated on Drawings..

2.5 TILE TRIM UNITS

A. Tile Trim Units: Except as otherwise specified or indicated in Color Codes on Drawings, provide trim units from same manufacturer, product line, color and finish, as each specified tile; and as follows:

1. Shapes: As selected by Architect from manufacturer's standard shapes; coordinate with adjacent tile sizes and jointing

a. Shapes include, but are not limited to, the following:

1) Bullnose units.
2) Cove base units.

2. Sizes: As selected by Architect from manufacturer's standard sizes; coordinate with adjacent tile sizes and jointing

2.6 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface.

a. Finish bevel to match top surface of threshold.

2. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Marble Threshold:

1. Comply with ASTM C503.
2. Abrasion Resistance: 10, minimum according to ASTM C1353 or ASTM C241 and with honed finish.
3. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.7 SETTING MATERIALS

A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bostik, Inc; Bostik PM: www.bostik.com.
b. Custom Building Products; VersaBond Flex Professional Thin-Set Mortar or Porcelain Tile Professional Thin-Set Mortar: www.custombuildingproducts.com.
c. LATICRETE International, Inc; 253 Gold or 254 Platinum: www.laticrete.com.
d. MAPEI Corp.; Ultraflex 2 or Ultraflex 3: www.mapei.com.
e. TEC, H.B. Fuller Construction Products Inc.; Full Flex Premium Thin Set Mortar or Super Flex Ultra-Premium Thin Set Mortar: www.tecspecialty.com.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

B. Large Format Tile, Modified Dry-Set Mortar (LHT Mortar/Medium-Bed): Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of up to 3/4 inch.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bostik, Inc; Big Tile & Stone: www.bostik.com.
b. Custom Building Products; Natural Stone & Large Tile Premium Mortar or Versabond LFT: www.custombuildingproducts.com.
c. LATICRETE International, Inc; 220 Marble & Granite Mortar or LHT Plus: www.laticrete.com.
d. MAPEI Corp.; Large Tile & Stone Mortar or Ultraflex LFT: www.mapei.com.
e. TEC, H.B. Fuller Construction Products Inc; Ultimate Large Tile Mortar: www.tecspecialty.com.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.8 GROUT MATERIALS

A. Epoxy Grout - Water-Cleanable: ANSI A118.3.

1. Grout Colors: As indicated in Color Codes on Drawings.
2. Products: Subject to compliance with requirements, provide one of the following:

a. Bostik, Inc; EzPoxy EzClean: www.bostik.com.
b. Custom Building Products; CEG-Lite 100% Solids Commercial Epoxy Grout: www.custombuildingproducts.com.
c. LATICRETE International, Inc; Spectralock Pro Premium or Spectralock Pro: www.laticrete.com.
d. MAPEI Corp.; Kerapoxy or Kerapoxy CQ: www.mapei.com.
e. TEC, H.B. Fuller Construction Products Inc.; AccuColor EFX Epoxy Special Effects Grout: www.tecspecialty.com.

2.9 WATERPROOFING AND CRACK ISOLATION MEMBRANE

A. Waterproofing and Crack Isolation Membrane: ANSI A118.10 and ANSI A118.12.

1. System consisting of liquid-latex rubber or elastomeric polymer; with or without fabric reinforcement
2. Thickness: As recommended by membrane manufacturer.
3. Crack Resistance: No failure at 1/8 inch gap, minimum.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Without Fabric Reinforcing:

a. Custom Building Products; RedGard: www.custombuildingproducts.com.
b. LATICRETE International, Inc; Hydro Ban: www.laticrete.com.
c. MAPEI Corp.; Mapelastic AquaDefense: www.mapei.com.

2. With Fabric Reinforcing:

a. Bostik, Inc; GoldPlus: www.bostik.com.
b. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane: www.custombuildingproducts.com.

c. LATICRETE International, Inc; Hydro Barrier: www.laticrete.com.
d. MAPEI Corp.; Mapelastic AquaDefense: www.mapei.com.
e. TEC, H.B. Fuller Construction Products Inc; HydraFlex: www.tecspecialty.com.

2.10 METAL TRIM

A. Metal Trim - General:

1. Except as otherwise indicated provide the following:

a. Metallic edge trim, height to match tile and setting-bed thickness, designed specifically for tiling applications; stainless steel, ASTM A276 or ASTM A666, 300 Series exposed-edge material.

1) Profiles:

a) Angle or L-shaped.
b) Other shapes as indicated on Drawings.

2) Finish: Brushed stainless steel.
3) Provide associated corner pieces, if any.
4) Applications and Locations: Unless otherwise indicated or finished with tile trim units, provide metal trim at the following locations:

a) Open edges of wall tile.
b) Open edges of floor tile.
c) Outside wall corners.
d) Transitions between hard tile and other floor finishes.
e) Tile perimeters not against a wall or other solid vertical surface.
f) Other areas as indicated on Drawings.

5) Manufacturers: Subject to compliance with requirements, provide products from one of the following:

a) Schluter-Systems: www.schluter.com.

2.11 MISCELLANEOUS MATERIALS

A. Joint Sealants

1. Tile Sealants - Traffic Grade:

a. Refer to Section 07 9200 - Joint Sealants.

1) Provide Nonsag traffic grade silicone sealant or self-leveling silicone sealant.

2. Tile Sealant - Non-traffic Grade: Gunnable siliconized acrylic; moisture and mildew resistant type.

a. Colors: To match adjacent grout colors.
b. Products: Subject to compliance with requirements, provide one of the following:

1) Bostik, Inc; Bosti-Flex Plus: www.bostik.com.
2) Custom Building Products; Polyblend Ceramic Tile Caulk: www.custombuildingproducts.com.
3) LATICRETE International, Inc; Premium Acrylic Caulk: www.laticrete.com.
4) MAPEI Corp.; Keracaulk S (sanded) and Keracaulk U (unsanded): www.mapei.com.

5) TEC, H.B. Fuller Construction Products Inc; AccuColor Sanded/Unsanded Siliconized Acrylic Caulk: www.tecspecialty.com.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

C. Trowelable Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

2.12 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

   a. Flatness tolerances shall also comply with requirements of specified TCNA installation methods.

2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

   a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable patching compound specifically recommended by tile-setting material manufacturer.

B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

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

3.3 INSTALLATION OF TILE

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation methods.

B. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in specified TCNA installation methods.

C. Tile shall have 80 percent mortar coverage except as follows:

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

a. Tile floors consisting of tiles 8 by 8 inches or larger.
b. Tile floors consisting of rib-backed tiles.

D. Bond Coats:

1. Use latex-portland cement thin-set mortar, unless otherwise indicated.

a. Exceptions:

1) For tiles that have at least one side greater than 15 inches long, use specified LHT mortar/medium-bed mortar.

b. Bond Coat Color: White or gray.

E. Grout:

1. Use epoxy grout.

F. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

G. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

H. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges except where metal trim is indicated.

I. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

J. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

K. Joint Widths: Install tiles with joint widths indicated, if not indicated install in widths as directed by Architect in writing.

L. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

M. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

N. Thresholds: Install thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

O. Metal Edge Strips: Install in same type of setting bed as adjacent tile unless otherwise indicated.

3.4 INSTALLATION OF WATERPROOF MEMBRANE

A. Install waterproofing and crack isolation membrane to comply with ANSI A108.13, ANSI A108.17 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproofing and crack isolation membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

C. Locations: Install waterproofing and crack isolation membrane at the following locations:

1. All floor and traffic areas.
2. Other areas as indicated on Drawings.

3.5 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR FLOOR TILE - INSTALLATION METHODS

A. Interior Floor Tile Installations:

1. Concrete Substrates - Thinset Installation: Install in accordance with TCNA F122 or F122A as appropriate for substrate conditions.

   a. Provide waterproofing and crack isolation membrane.
   b. Bond Coat: LHT mortar/medium-bed mortar as appropriate to tile.
   c. Grout: Epoxy grout.

3.8 INTERIOR WALL TILE - INSTALLATION METHODS

A. Interior Wall Tile Installations:

1. Cementitious Backing Panel Substrates - Thinset Installation: Install in accordance with TCNA W244C.

   a. Provide waterproofing and crack isolation membrane at specified locations and as indicated on Drawings.
   b. Bond Coat: LHT mortar/medium-bed mortar as appropriate to tile
   c. Grout: Epoxy grout.

2. Glass-Mat Backing Panel Substrates - Thinset Installation: Install in accordance with TCNA W245.

   a. Provide waterproofing and crack isolation membrane at specified locations and as indicated on Drawings.
   b. Bond Coat: LHT mortar/medium-bed mortar as appropriate to tile
   c. Grout: Epoxy grout.

END OF SECTION 09 3000

SECTION 09 5113 – ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Acoustical panels.
2. Metal suspension systems.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For components with factory-applied finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Set of 6-inch-square Samples of each type, color, pattern, and texture.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.
4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including, but not limited to, the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: For each type, finish, and color, full-size panels equal to 2 percent of quantity installed but not less than one box.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed but not less than one box for each type, finish, and color.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, 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. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.11 WARRANTY

A. Special Warranties: Provide the following manufacturer warranties:

1. Acoustic Panel Warranty: Manufacturer agrees to repair or replace panels that fail in materials or workmanship within specified warranty period.

a. Failures include, but are not limited to, the following:

1) Sagging acoustical panels.
2) Mold and mildew growth on panels.

b. Warranty Period 30 years from date of Substantial Completion.

2. Metal Suspension Systems: Manufacturer agrees to repair or replace suspension systems that fail in materials or workmanship within specified warranty period.

   a. Failures include, but are not limited to, the following:

      1) Rusting grid members or components.

   b. Warranty Period 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acoustic Panels: The design for each acoustic panel specified is based on the product indicated in Color Codes on Drawings. Subject to compliance with requirements, provide either the named product or a comparable product by one of the following:

1. Armstrong World Industries, Inc: www.armstrongceilings.com.
2. CertainTeed Corporation: www.certainteed.com.
3. Rockfon North America: www.rockfon.com.
4. USG Corporation: www.usg.com.

B. Metal Suspension Systems: The design for each metal suspension system specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the following:

1. Armstrong World Industries, Inc: www.armstrong.com.
2. CertainTeed Corporation: www.certainteed.com.
3. Rockfon North America/Chicago Metallic: www.rockfon.com.
4. USG Corporation: www.usg.com.

C. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 50 or less.

B. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.3 ACOUSTICAL PANELS

A. General:

1. Acoustical Panel Standard: Provide manufacturer's standard panels that comply with ASTM E1264.

B. Acoustical Panels: Refer to Color Codes on Drawings.

2.4 METAL SUSPENSION SYSTEM

A. General:

1. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635 and designated by type, structural classification, and finish indicated.

B. 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, G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. Face Design: Flat, flush.
3. Cap Material: Cold-rolled steel or aluminum.
4. Cap Finish: Painted white.
5. Basis-of-Design Product Armstrong World Industries, Inc.; Prelude XL: www.armstrong.com.
6. Basis-of-Design Product USG Corporation; USG Donn Brand DX: www.usg.com.

C. Metal Edge Moldings and Trim: Provide edge molding and trim for each metal suspension-system.

1. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

a. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
b. 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.
c. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2. Miscellaneous Moldings: Same material, finish, and color as that used for exposed flanges of suspension-system runners.

a. Provide inside and outside prefabricated corner moldings.
b. At Bullnose Corners: Provide radius corner moldings to match bullnose radius of adjacent walls.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E488 or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Cast-in-place or postinstalled expansion anchors.
b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B633, Class SC 1 (mild) service condition.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch-diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A653, G90 (Z275) coating designation; with bolted connections and 5/16-inch-diameter bolts.

2.6 ACOUSTICAL ACCESSORIES

A. Acoustical Sealant: As specified in Section 07 9200 - Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. 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 unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636 and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. 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.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure 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.

5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
4. Corners:

    a. At Bullnose Corners: Provide prefabricated radius corner moldings to match bullnose radius of walls.
    b. At Square Corners: Provide prefabricated corner moldings.
    c. At Other Angles Corners: Overlap perimeter moldings.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. 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.
4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 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.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

SECTION 09 6513 – RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Resilient wall base.
2. Resilient molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Wall Base: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, profile, and size installed.
2. Resilient Molding Accessories: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, profile, and size installed.
3. Resilient Stair Accessories: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, texture, profile, and size installed.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong Flooring Inc.: www.armstrongflooring.com.
    b. Mannington Mills, Inc./Burke Flooring: www.manningtoncommercial.com.
    c. Johnsonite, a Tarkett Company: www.johnsonite.com.
    d. Roppe Corp: www.roppe.com.

2. Style and Location:

    a. Style A - Straight: Provide in areas with carpet unless otherwise indicated; and where indicated on Drawings.
    b. Style B - Cove: Provide in areas with hard surface floor coverings, unless otherwise indicated; and where indicated on Drawings.

3. Thickness: 0.125 inch.
4. Height: 4 inches.
5. Lengths: Coils in manufacturer's standard length.
6. Outside Corners: Job formed.
7. Inside Corners: Job formed.
8. Colors: Equal to colors indicated in Color Codes on Drawings.

2.2 RESILIENT MOLDING ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products from one of the following:

1. Armstrong Flooring Inc.: www.armstrongflooring.com.
2. Mannington Mills, Inc./Burke Flooring: www.manningtoncommercial.com.
3. Johnsonite, a Tarkett Company: www.johnsonite.com.
4. Roppe Corp: www.roppe.com.

B. Resilient edge and transition strips for changes in flooring materials.

1. Material: Rubber.
2. Profile and Dimensions: As standard with manufacturer and as follows:

a. As appropriate for floor finishes.
b. As indicated on Drawings.

3. Provide floor moldings at the following locations unless otherwise indicated:

a. Open perimeters of resilient flooring; reducer strips.
b. Open perimeters of carpeting; edge guards.
c. Changes in floor finishes from resilient flooring to carpeting; transition strips.
d. Changes in elevation: Tapered substrate transition strips; provide for smooth flooring transitions.
e. Other areas as indicated on Drawings or required for complete floor finish installations.

4. Colors and Patterns: Standard colors as selected by Architect.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.

4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft.in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Bend around corners; form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Miter corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Install floor moldings in one piece for full width of installation, where possible

1. Where joints are unavoidable, fit tightly together and align adjacent molding profiles

C. Butt to adjacent materials and tightly adhere to substrates throughout length of each piece.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 6513

SECTION 09 6543 – LINOLEUM FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Linoleum sheet flooring.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of linoleum flooring.

1. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Initial Selection: For each type of linoleum flooring, in manufacturer's standard size, but not less than 6 by 9 inches.

D. Samples for Verification: For each type of linoleum flooring, in manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern required.

1. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

E. Product Schedule: For linoleum flooring. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of linoleum flooring to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience, and as follows:

1. Engage an installer who employs workers for this Project who are approved, trained or certified by linoleum flooring manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F or more than 90 deg F.

1. Sheet Flooring: Store rolls upright.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring during the following periods:

1. 72 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during flooring installation.

D. Close spaces to traffic for 72 hours after flooring installation.

E. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For linoleum flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LINOLEUM SHEET FLOORING

A. Linoleum Sheet Flooring: Refer to Color Codes on Drawings. Substitutions not permitted.

1. Linoleum Sheet Flooring: ASTM F2034
2. Colors and Patterns:

a. Colors: As indicated in Color Codes on Drawings.
b. Patterns: As indicated on Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by linoleum flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of flooring.

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

3.2 PREPARATION

A. Prepare substrates according to linoleum flooring manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by linoleum flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by linoleum flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install flooring until materials are the same temperature as space where they are to be installed.

1. At least 72 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing flooring.

B. Scribe and cut flooring to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, thresholds, door frames, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.

E. Adhere flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 LINOLEUM SHEET FLOORING INSTALLATION

A. Unroll linoleum sheet flooring and allow it to stabilize before cutting and fitting.

B. Lay out linoleum sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.
5. Eliminate deformations that result from hanging method used during drying process (stove bar marks).

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting linoleum flooring.

B. Perform the following operations immediately after completing linoleum flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect linoleum flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover linoleum flooring until Substantial Completion.

END OF SECTION 09 6543

SECTION 09 6813 – TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Carpet tile.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:

a. Review delivery, storage, and handling procedures.
b. Review ambient conditions and ventilation procedures.
c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Transition details to other flooring materials.

C. Samples for Initial Selection: For each type of carpet tile.

D. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience, and as follows:

1. Shall be certified by the International Certified Floorcovering Installers Association at the Commercial II certification level

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

1.10 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.11 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

2. Failures include, but are not limited to, the following:

   a. More than 10 percent edge raveling, snags, and runs.
   b. Dimensional instability.
   c. Excess static discharge.
   d. Loss of tuft-bind strength.
   e. Loss of face fiber.
   f. Delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance Characteristics:

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
2. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.2 CARPET TILE

A. Carpet Tile: Refer to Color Codes on Drawings. Substitutions not permitted.

1. Colors and Patterns:

   a. Colors: As indicated in Color Codes on Drawings.
   b. Patterns: As indicated on Drawings.

2. Installation Method: As selected by Architect, unless otherwise indicated on Drawings.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

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

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer but not less than the following:

1. Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns as indicated on Drawings and as recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 6813

SECTION 09 6816 – SHEET CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Sheet carpeting.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet installation including, but not limited to, the following:

a. Review delivery, storage, and handling procedures.
b. Review ambient conditions and ventilation procedures.
c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet installation, showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Seam locations, types, and methods.
4. Type of subfloor.
5. Type of installation.
6. Pattern type, repeat size, location, direction, and starting point.
7. Pile direction.
8. Types, colors, and locations of insets and borders.
9. Types, colors, and locations of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples for Initial Selection: For each type of carpet.

D. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: 12 inch square Sample.
2. Carpet Seam: 6-inch Sample.

E. Product Schedule: For carpet. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Product Test Reports: For carpet, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience, and as follows:

1. Shall be certified by the International Certified Floorcovering Installers Association at the Commercial II certification level

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.

1.10 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

1.11 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent edge raveling, snags, and runs.
b. Excess static discharge.
c. Loss of tuft-bind strength.
d. Delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance Characteristics:

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
2. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.2 CARPET

A. Carpet: Refer to Color Codes on Drawings. Substitutions not permitted.

1. Colors and Patterns:

a. Colors: As indicated in Color Codes on Drawings.
b. Patterns: As indicated on Drawings.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance.

B. Examine carpet for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
c. Perform additional moisture tests recommended in writing by adhesive and carpet manufacturers. Proceed with installation only after substrates pass testing.

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

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with the Carpet and Rug Institute's CRI 104 and carpet manufacturer's written installation instructions for the following:

1. Direct-glue-down installation.

B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Install as indicated on Drawings.

D. Install borders with mitered corner seams.

E. Do not bridge building expansion joints with carpet.

F. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

G. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with the Carpet and Rug Institute's CRI 104.

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 09 6816

SECTION 09 9100 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior painting.
2. Painted lettering

1.3 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section

B. DFT: Dry film thickness, measured in mils.

C. WFT: Wet film thickness, measured in mils.

D. Mils: One one-thousandth of an inch. Used to measure thickness of coating films.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions. Include the following:

1. Indicate VOC content.
2. Manufacturer's name, product name and/or catalog number, and general product category.

a. Example of general product categories:

1) Interior finish coat - latex, eggshell.
2) Exterior primer for ferrous metal.

3. For each paint system and substrate, indicate which paint products are to be used.

a. Examples:

1) Interior latex eggshell system for gypsum board:

a) Primer: Name of specific product provided.
b) Finish Coats: Name of specific product provided.

2) Exterior latex semigloss system for ferrous metals.

a) Primer: Name of specific product provided.
b) Finish Coats: Name of specific product provided.

4. Use same designations indicated on Drawings and Schedules.

B. Shop Drawings: For painted lettering.

1. Include elevations showing lettering locations.
2. Show message/wording, font styles, font heights, and graphic elements.
3. Include paint system descriptions.
4. Indicate colors and finishes.

C. Samples: Submit 3 paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating each color and finish specified.

1. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry and storefront finishes, have been approved.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer and manufacturer.

B. Paint Compatibility Certificates:

1. For Steel: From manufacturers of field-applied primers and top coats, certifying material compatibility with one another and shop-applied primers.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Paint Maintenance Manual: Submit coating maintenance manual including:

1. Finish schedule showing where each product, color, and finish was used.
2. Product technical data sheets.
3. Material safety data sheets (MSDS).
4. Care and cleaning instructions.
5. Touch-up procedures.
6. Repair of painted and finished surfaces.

B. Color Chips: After final approval of all colors, submit color chips of all coatings used with manufacturer's name, product, and mix formulation of each color, finish, and coating for the purpose of future re-ordering of coatings.

1. Color chips shall be at least six (6) inches square.
2. Include in Paint Maintenance Manual.

C. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 2 percent of that installed, but not less than 1 gal. of each material, color, and finish applied.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum 5 years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years documented experience.

1. Only qualified journeypersons, as defined by local jurisdiction, shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyperson in accordance with trade regulations.

1.8 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.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.9 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

C. Apply paint only to dry, clean, and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations:

1. Provide paint and coating products from same manufacturer, unless otherwise specified.
2. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats, unless otherwise specified.
3. Exceptions shall be permitted, provided approval of Architect is obtained using specified procedures for substitutions.

B. Paint Manufacturers - General: For each paint type specified in Part 2, provide one of the products listed, subject to compliance with requirements. Products shall be from one of the following:

1. Benjamin Moore: Benjamin Moore & Co.: www: benjaminmoore.com.
2. PPG: PPG Industries, Inc., Architectural Coatings: www.ppgpaints.com.
3. Sherwin-Williams: The Sherwin-Williams Company: www: sherwin-williams.com.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be 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, products shall be recommended in writing by top coat manufacturers for use in paint system and on substrate indicated.

B. VOC Content:

1. Comply with the following:

a. Michigan Department of Environment, Great Lakes, and Energy's (EGLE) air pollution rules, Part 6: Emission Limitations and Prohibitions – Existing Sources of Volatile Organic Compound Emissions.
b. Ozone Transport Commission (OTC), Model Rule for Architectural and Industrial Maintenance (AIM) Coatings; as referenced in EGLE's air pollution rules, Part 6.

1) OTC Phase II.

2. Content Limits:

a. The following paint and coating categories are as defined by OTC, Model Rule for Architectural and Industrial Maintenance (AIM) Coatings. Paints and coatings shall comply with the following VOC content limits unless stricter limits are required by authorities having jurisdiction:

1) Flat Coatings: 50g/L.
2) Non-flat Coatings: 100g/L.
3) Non-flat High Gloss Coatings: 150g/L.
4) Dry Fog (Dryfall) Coatings: 150g/L.
5) Industrial Maintenance Coatings: 250g/L.
6) Primers, Sealers, and Undercoaters: 100g/L.
7) Specialty Primers, Sealers, and Undercoaters: 100g/L
8) Rust Preventative Coatings: 250g/L.
9) Zinc Rich Primers: 340g/L.

C. Supply each paint material in quantity required to complete entire project's work from a single production run.

D. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

E. Paint Finishes: Gloss (sheen) levels.

1. Paint finishes shall be defined by the paint's gloss (sheen) level according to ASTM D523, using 60 and 85 degree geometry. Paint finish gloss levels shall be as follows:

a. Level 1 – Flat (Matte): Comply with both of the following:

1) 60 Degrees: Value not more than 5 units.
2) 85 Degrees: Value not more than 10 units.

b. Level 2 – Velvet: Comply with both of the following:

1) 60 Degrees: Value not more than 10 units.
2) 85 Degrees: Value between 10 and 35 units.

c. Level 3 – Eggshell: Comply with both of the following:

1) 60 Degrees: Value between 10 and 25 units.
2) 85 Degrees: Value between 10 and 35 units.

d. Level 4 – Satin: Comply with both of the following:

1) 60 Degrees: Value between 20 and 35 units.
2) 85 Degrees: Value not less than 35 units.

e. Level 5 – Semigloss:

1) 60 Degrees: Value between 35 and 70 units.

f. Level 6 – Gloss:

1) 60 Degrees: Value between 70 and 85 units.

g. Level 7 – High Gloss:

1) 60 Degrees: Value more than 85 units.

2. Product names are not acceptable for paint finish identification.
3. For Part 2 of this Section paint finishes shall be defined as follows:

a. Flat Finish: Complying with ASTM D523 Level 1.
b. Low Luster Finish: Complying with ASTM D523 Level 2, 3 or 4.
c. Semigloss Finish: Complying with ASTM D523 Level 5.
d. Gloss Finish: Complying with ASTM D523 Level 6 or 7.

4. Where paint finishes are not specified, provide finish as selected by Architect.

F. Colors: As indicated in Room Finish Schedule on Drawings or, if not indicated, to match Architect's samples.

1. Tint each coat including intermediate coats, one-half shade lighter than succeeding coat, with final top coat as indicated color.
2. Provide tinted deep tone primers at deep tone colors, and as recommended by paint manufacturer.

2.3 INTERIOR PAINTS

A. General:

1. Unless otherwise indicated, each interior paint system consists of the following:

a. Primer: One coat based on substrate material.
b. Intermediate Coats: One coat, if indicated, based on substrate material.
c. Top Coats: Two coats, one if intermediate coat was applied, based on required finish and substrate material.

2. Required Finishes: For each paint system, provide paint finishes as follows unless otherwise indicated:

a. Ceilings, Soffits and Ceiling Drops: Flat finish.
b. Gypsum Board (except at ceilings):

1) Semigloss Finish: Storage rooms, janitor closets, electrical rooms, mechanical rooms, closets, and similar non-public areas.
2) Low Luster Finish: Public areas.

c. Concrete (except at ceilings): Semigloss finish.
d. Masonry: Semigloss finish.
e. Metals: Semigloss finish.

f. Insulated Piping and Insulated Ductwork: Finish to match surface it is mounted on unless otherwise indicated.

B. Interior Paint Systems - Latex.

1. Primers:

a. Primer for concrete: Alkali-resistant acrylic/latex primer, water-based.

1) Benjamin Moore; Ultra Spec High Build Masonry Primer N609; DFT 2.0 to 3.0 mils.
2) PPG; Perma-Crete Interior/Exterior Alkali Resistant Primer 4-603XI; DFT 1.4 to 2.6 mils.
3) Sherwin Williams; Loxon Concrete and Masonry Primer-Sealer LX02; DFT 2.1 to 3.2 mils.

b. Block Filler/primer for concrete masonry units: Acrylic/latex block filler, water-based.

1) Benjamin Moore; Ultra Spec Hi-Build Masonry Block Filler 571; DFT 8.5 to 11.0 mils.
2) PPG: Speedhide Interior/Exterior Masonry Hi Fill Latex Block Filler 6-15XI; DFT 8.0 mils.
3) Sherwin Williams; Pro Industrial Heavy Duty Block Filler B42 Series; DFT 9.08.0 to 10.5 mils.

c. Primer for aluminum, ferrous metal, and galvanized steel: Rust-inhibitive acrylic/latex primer, water-based.

1) Benjamin Moore; Ultra Spec HP Acrylic Metal Primer HP04; DFT 1.7 to 2.3 mils.
2) PPG; Pitt-Tech Plus Int./Ext. DTM Industrial Primer 4020PF; DFT 2.2 to 3.5 mils.
3) Sherwin Williams; Pro Industrial Pro-Cryl Universal Primer B66 Series; DFT 1.9 to o3.8 mils.

d. Primer for gypsum board: Acrylic/latex primer, water-based.

1) Benjamin Moore; Super Hide Zero VOC interior Latex Primer 354; DFT 1.3 mils.
2) PPG; Speedhide Zero Interior Zero VOC & Low Odor Primer 6-4900XI; DFT 1.4 mils.
3) Sherwin Williams; ProMar 200 Zero V.O.C. Interior Latex Primer, B28W02600; DFT 1.0 mils.

e. Primer for previously painted surfaces; including concrete and masonry: Acrylic/latex stain-blocking primer/sealer with high adhesion, water-based.

1) Benjamin Moore; Insl-X Prime All Multi-Surface Latex Primer Sealer AP-1000; DFT 1.3 mils.
2) PPG; Seal Grip Gripper Interior/Exterior 100% Acrylic Latex Primer 17-921XI Series; DFT 1.6 mils.
3) Sherwin Williams; PrepRite ProBlock Interior-Exterior Latex Primer-Sealer B51-600 Series; DFT 1.4 mils.

2. Intermediate Coats: Provide intermediate coats only where indicated below for specific manufacturers, finishes and substrate materials.

a. Low Luster Finishes:

1) Intermediate coats for aluminum, ferrous metal, and galvanized steel:

a) Benjamin Moore; Ultra Spec HP D.T.M. Acrylic Low Luster Enamel HP25; DFT 1.8 to 2.5 mils.

3. Top Coats:

a. Semigloss Finish: Acrylic/latex paint, water-based.

1) Finish coats for all surfaces except metals:

a) Benjamin Moore; Super Hide Interior Latex Semi-Gloss 298; DFT 1.2 to 1.4 mils.
b) PPG; Speedhide Zero Interior Latex Semi-Gloss 6-5510 Series; DFT 1.5 mils.
a) Sherwin-Williams; ProMar 200 Zero V.O.C. Interior Latex Gloss B21-12650 Series; DFT 1.4 mils.

2) Finish coats for aluminum, ferrous metal, and galvanized steel:

a) Benjamin Moore; Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel WH29; DFT 2.3 mils.
b) PPG; Pitt-Tech Plus EP DTM Acrylic Semi-Gloss 90-1610 Series; DFT 2.0 to 4.0 mils.
c) Sherwin-Williams; Pro Industrial DTM Acrylic Semi-Gloss B66 Series; DFT 2.4 to 4.0 mils.

b. Low Luster Finish: Acrylic/latex paint, water-based.

1) Finish coats for all surfaces except metals:

a) Benjamin Moore; Super Hide Interior Latex Low Sheen Eggshell 296; DFT 1.3 to 1.5 mils.
b) PPG; Speedhide Zero Interior Latex Paint Satin 6-5410 Series; DFT 1.4 mils.
a) Sherwin-Williams; ProMar 200 Zero V.O.C. Interior Latex Eg-Shel B20 Series; DFT 1.8 mils.

2) Finish coats for aluminum, ferrous metal, and galvanized steel:

a) Benjamin Moore; Super Hide Interior Latex Eggshell 297; DFT 1.3 to 1.4 mils.
b) PPG; Pitt-Tech Plus EP DTM Acrylic Satin 90-1710 Series; DFT 2.0 to 4.0 mils.
c) Sherwin-Williams; Pro Industrial DTM Acrylic Eg-Shel B66 Series; DFT 2.5 to 4.0 mils.

c. Flat Finish: Acrylic/latex paint, water-based.

1) Finish coats for all surfaces:

a) Benjamin Moore; Super Hide Interior Latex Flat 295; DFT 1.4 to 1.5 mils.
b) PPG; Speedhide Zero Interior -Latex Paint Flat 6-5110 Series; DFT 1.2 mils.
c) Sherwin Williams; ProMar 200 Zero V.O.C. Interior Latex Flat B30-2600 Series; DFT 1.4 mils.

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide cleaning materials, preparation materials, and miscellaneous materials required to properly prepare and apply paints and coatings.

1. Includes materials required for marking fire and smoke assemblies

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.
3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Protect adjacent surfaces not to be painted.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. For coatings applied over previously painted surfaces, test application to check for lifting and other adhesion problems. Perform test in an isolated area where practicable.
2. Remove incompatible coatings and primers or apply barrier tie coat as recommended by paint manufacturer and as required to produce paint systems indicated.

D. Remove hardware, covers, plates, and similar items already in place that are removable and 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.

E. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

1. Clean concrete according to ASTM D4258. Allow to dry.

F. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

G. Steel Substrates - Unpainted or Unprimed: Remove rust, loose mill scale, and any other surface contamination. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 6 - Commercial Blast Cleaning.

H. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Sand and scrape to remove loose primer and rust. Feather edges of remaining primer to make inconspicuous.

1. Clean using methods recommended in writing by paint manufacturer.
2. Before applying finish coats, applicator/installer shall re-prime entire shop-primed item with steel primer specified in this section.

I. Galvanized-Metal Substrates: Remove passivation coating/rinse, grease and oil residue from galvanized metal to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints. Clean using methods recommended in writing by paint manufacturer but not less than ASTM D6386, ASTM D7396, and the following:

1. Remove surface contamination and oils in accordance with SSPC-SP 1 - Solvent Cleaning.
2. Remove loose paint, rust, and other debris according to SSPC-SP 2 - Hand Tool Cleaning.
3. Lightly profile galvanized surfaces and remove zinc oxide and zinc hydroxide layers in accordance with SSPC-SP16 – Brush-Off/Sweep Blast Cleaning.
4. Apply paint within 1 hour of cleaning and preparation.

J. Aluminum Substrates: Remove loose surface oxidation. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 1 - Solvent Cleaning.

K. Previously Painted Surfaces - General:

1. Remove all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, and any other surface contamination.
2. Remove masking tape, labels, adhesives, and other materials that would either be deleterious to adhesion of, or show through, new paint.
3. Scrape all loose, blistered, peeling, scratched or otherwise imperfect paint down to bare substrate and sand adjacent tightly adhering paint to feather edge.
4. Spot prime all bare areas with appropriate primer before priming entire surface.

L. Repair of Existing Gypsum Board:

1. Fill hairline cracks, small holes, and imperfections with filler compound and sand smooth.

3.3 APPLICATION - GENERAL

A. Apply paints and coatings according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.

B. Provide smooth, opaque coatings of uniform finish, color, appearance, and coverage without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.

C. Terminate paint in neat lines; cut in sharp lines and color breaks.

D. Apply paint products to properly prepared surfaces.

1. Do not apply coatings over dirt, rust, scale, grease, moisture, or other conditions detrimental to application of coatings.

E. Primers:

1. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
2. Apply first coat of primer to surfaces as soon as practical after preparation and before subsequent surface deterioration.
3. Re-prime shop-primed surfaces.

F. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.

1. Sand between coats as recommended by manufacturer; before applying next coat clean surfaces of loose particles and use tack cloth to remove any remaining dust and particles just prior to applying next coat.

G. Provide completed work matching approved samples for color, finish, texture, coverage and quality of work.

1. Remove, refinish, or repaint work not complying with requirements.

H. Number of Coats: Each paint system in Part 2 specifies a number of coats. This is the minimum number required.

1. If undercoats, stains, or other imperfections are visible after final coat of paint, apply additional coats until paint is of uniform finish, color, and appearance without defects or imperfections.

I. Minimum Coating Thickness: Provide dry film thickness for each coating as indicated, but not less than that recommended by the coating manufacturer.

1. Number of coats and film thicknesses required are same regardless of application method.
2. Ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.

3.4 PAINTED LETTERING

A. Painted Characters: Paint characters with precisely drawn lines and profiles; and as follows:

1. Paint System: As appropriate for substrates indicated on Drawings; primer and two finish coats in the same sheen as surface it is painted on unless otherwise indicated.
2. Character Heights: As indicated on Drawings
3. Typeface/Fonts: As indicated on Drawings.
4. Includes Graphics and Logos: Shapes and designs as indicated on Drawings, if any.
5. Colors: As indicated on Drawings.

3.5 SURFACES TO BE PAINTED

A. General: Paint all exposed surfaces except where indicated not to be painted or where listed in “Surfaces Not to Be Painted” Article in this section.

1. The term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.
2. If surface, material, or item is not specifically mentioned, paint in same manner, color, and sheen as similar surfaces, materials, or items, regardless of whether indicated or not.

3. Paint surfaces that are cut and patched including, but not limited to, cutting and patching to permit installation of electrical services, piping, and ductwork.

B. Exposed Ceilings:

1. Paint entire exposed ceiling area including, but not limited to, deck, miscellaneous steel, hangers, fasteners, and miscellaneous items and hardware, unless otherwise indicated.
2. Paint the following mechanical and electrical items unless otherwise indicated:

a. Insulated piping, pipe hangers, and supports
b. Ductwork, insulated ducts, and supports.
c. Conduit, fittings and junction boxes:

3. Do not paint sprinkler heads and other factory finished fire protection components.

C. Equipment and Furniture:

1. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces.
2. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of permanent item.

D. Registers and Grilles: Paint interior surfaces of ducts, for a minimum of 18 inches or beyond sight line, whichever is greater, with a flat black (non-reflecting) paint.

E. Access Panels: Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

F. Doors:

1. Exterior Doors: Finish doors on tops, bottoms, and all four edges the same as exterior faces.
2. Interior Doors: Finish doors on tops, bottoms, and all four edges the same as face of non-secured side.

G. Panelboards for Service Panels, Telephone, and Other Electrical Equipment:

1. Paint both sides and all edges of plywood before installation.

a. Color and Finish: Gray, semigloss, unless otherwise indicated.

H. Mechanical and Electrical:

1. This Section includes painting of all mechanical, fire protection, and electrical items.

a. Do not paint sprinkler heads and polished fire protection components.
b. Do not paint insulated pipe, duct work or equipment before insulation is applied.

2. Piping, Insulated Piping, Pipe Hangers, and Supports:

a. In finished/public areas, paint exposed piping the same color and finish as surface it is mounted on unless otherwise indicated.
b. In utility areas, paint exposed piping according to piping color coding scheme; otherwise paint the same color and finish as surface it is mounted on unless otherwise indicated.
c. Paint all exposed pipe hangers and supports the same color and finish as surface it is mounted on unless otherwise indicated.

1) Any portion of hangers and supports encompassing the actual pipe shall be painted to match the pipe color and finish.

3. Ductwork, Insulated Ducts, and Supports:

    a. In finished/public areas, paint exposed ductwork and supports the same color and finish as surface it is mounted on unless otherwise indicated.
    b. In utility areas, paint exposed ductwork according to color coding scheme; otherwise paint the same color and finish as surface it is mounted on unless otherwise indicated.
    c. Paint all exposed hangers and supports the same color and finish as surface it is mounted on unless otherwise indicated.

        1) Any portion of hangers and supports encompassing the actual ductwork shall be painted to match the ductwork color and finish.

4. Electrical Conduit, Fittings and Junction Boxes:

    a. In finished/public areas, paint exposed conduit, fittings and junction boxes same color and finish as surface it is mounted on unless otherwise indicated.
    b. In utility areas, paint exposed conduit, fittings and junction boxes according to color coding scheme; otherwise paint the same color and finish as surface it is mounted on unless otherwise indicated.

5. Mechanical and Electrical Equipment:

    a. Exterior Equipment: Paint all equipment exposed to the weather.

        1) Do not paint factory-finished equipment unless otherwise indicated.

    b. Paint shop-primed mechanical and electrical equipment same color and finish as surface it is mounted on unless otherwise indicated.
    c. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
    d. Paint interior surfaces of convector and baseboard heating cabinets to match face panels.

3.6 SURFACES NOT TO BE PAINTED

A. Do not paint or finish the following unless otherwise indicated:

1. Factory-finished items; factory-primed items are not considered factory-finished.
2. Items indicated to receive other finish.
3. Items indicated to remain naturally finished.
4. Fire rating labels.
5. Equipment serial number and capacity labels.
6. Operating parts of equipment.
7. Aluminum components.
8. Polished and brushed stainless steel items.
9. Metal flashings.
10. Brick.
11. Decorative concrete masonry units.
12. Cast-in-place concrete.
13. Floors.
14. Surfaces concealed by suspended ceilings.
15. Concealed piping, ductwork, and conduit.
16. Surfaces within pipe and duct spaces.
17. Acoustical materials.

3.7 IDENTIFICATION AND COLOR CODING

A. Marking Fire and Smoke Assemblies.

1. Permanently identify both sides of each fire and smoke assembly indicated on Drawings.

a. Labeling:

1) Labeling may be either painted stencils or preprinted self-adhesive stickers.
2) Lettering not less than 3 inches in height, minimum 3/8 inch stroke width, in contrasting color to wall. Example of wording as follows:

a) "2 HOUR FIRE BARRIER - PROTECT ALL OPENINGS" or similar.

3) Colors and exact wording of labels shall comply with local code(s).

b. Locations:

1) Locate labels within 15 feet of the ends of each wall and intervals not to exceed 30 feet measured horizontally along the wall. Minimum of one label per run of wall.

a) Locate approximately 12 to 24 inches below ceiling/roof deck unless otherwise required by local code(s).
b) In occupied areas without ceilings do not apply labels.

c. Where multiple ratings occur in single run of wall:

1) Apply vertical stripe 2 inches wide and approximately 12 inches high where rating change occurs; use contrasting color to wall.
2) In occupied areas without ceilings do not apply.
3) Comply with local code(s).

B. Mechanical and Electrical Identification and Color Coding:

1. Refer to Divisions 21, 22, 23, and 26 for color coding scheme and identification of mechanical and electrical services; if no identification is provided, paint as follows:

a. Color Coding Scheme and Identification:

1) Piping: None; paint to match surface on which it is mounted unless otherwise indicated.
2) Ductwork: None; paint to match surface on which it is mounted unless otherwise indicated.
3) Conduit: None; paint to match surface on which it is mounted unless otherwise indicated.

3.8 FIELD QUALITY CONTROL

A. Subject to the opinion of the Architect, paint shall be rejected and considered unacceptable for any of the following reasons:

1. Lacking minimum dry film thicknesses.
2. Poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, and corners.
3. Damage from touching, or disturbing paint in any other manner, before sufficiently dry.
4. Damage from application to moist surfaces or damage caused by inadequate protection from the weather.
5. Damage or contamination of paint from blown contaminants including but not limited to dust.

6. Paint shall be rejected if any of the following are evident under natural lighting for exterior surfaces and final lighting source, including daylighting, for interior surfaces:

    a. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 48 inches.
    b. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 48 inches.
    c. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles from a distance of not less than 48 inches.

B. Visible defects are defined as follows:

1. Brush and roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
2. When the final coat on any surface exhibits a lack of uniformity of color, finish, texture, and hiding across full surface area.

C. Rejected paint shall be repaired or replaced at the expense of the Contractor.

1. Small affected areas shall be touched up.
2. Large affected areas shall be repainted.
3. Small and large areas shall be as defined by the Architect.
4. Areas without sufficient dry film thickness shall be repainted.
5. Paint runs and sags shall be removed by scraper or sanding and repainted.

3.9 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water. Prevent solvents, thinners, cleaners, and other contaminants from entering waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.

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. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 9100

SECTION 10 2600 – WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Corner guards.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of products specified in this section with size, location and installation of service utilities

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long. Include example top caps.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Material Certificates: For each type of exposed plastic material.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least 5 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store wall protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).

a. Store corner-guard covers in a vertical position.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.3 CORNER GUARDS

A. Surface-Mounted, Plastic Corner Guards: Fabricated as one piece from manufacturer's standard, PVC-free plastic.

1. Drawing Designation: CG Series
2. Basis of Design: Subject to compliance with requirements, provide Construction Specialties, Inc; Model VA-250N: www.c-sgroup.com, or a comparable product from one of the following:

a. Inpro Corp: www.inprocorp.com
b. Koroseal Interior Products, LLC: www.koroseal.com.
c. Pawling Corporation: www.pawling.com.

3. Corner Guard: Extruded rigid plastic, minimum 0.090-inch wall thickness; as follows:

a. Profile: Nominal 2-1/2-inch-long leg and 3/32-inch corner radius.
b. Height: As indicated on Drawings.
c. Color and Texture: As indicated in Color Codes on Drawings.

4. Mounting: Manufacturer's standard self-adhesive mounting tape.

2.4 MATERIALS

A. Adhesive: As recommended by protection product manufacturer.

2.5 FABRICATION

A. Fabricate wall protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and 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.

2.6 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

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

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall protection according to manufacturer's written instructions, 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.

B. Mounting Heights: Install wall protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Adjust end and top caps as required to ensure tight seams.

3.4 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 10 2600

SECTION 10 2800 – TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Toilet accessories.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify accessories using designations indicated on Drawings

C. Samples for Initial Selection: For each type of finish material indicated.

D. Samples for Verification: When requested by Architect, for each type of material, color, and finish required, 2 by 2 inches in size:

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

1.8 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:

1. Toilet Accessories: The design for each item specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the following:

a. American Specialties, Inc, (ASI): www.americanspecialties.com.
b. Bobrick Washroom Equipment, Inc.: www.bobrick.com.
c. Bradley Corporation: www.bradleycorp.com.

B. Source Limitations: Obtain each type of toilet from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.3 MATERIALS

A. Stainless Steel: ASTM A240 or ASTM A666, Type 304, 0.031-inch-minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B19, flat products; ASTM B16, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

C. Steel Sheet: ASTM A1008, Designation CS (cold rolled, commercial steel), 0.036-inch-minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A653, with G60 hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A153, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

2.5 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.6 TOILET ACCESSORIES

A. Toilet Paper Dispenser: Owner furnished; Contractor installed.

B. Paper Towel Dispenser: Owner furnished; Contractor installed.

C. Soap Dispenser: Owner furnished; Contractor installed.

D. Sanitary-Napkin Disposal Unit:

1. Description: Hinged disposal door with hinged unit cover and tumbler lock.
2. Mounting: Surface mounted.
3. Operation: Self-closing, disposal door.
4. Capacity: 1/2 gallon.
5. Material: Stainless steel with reusable vinyl waste receptacle liner.
6. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-254.

E. Mirrors:

1. Frame: Stainless steel angle, 0.05 inch thick; with corners welded and ground smooth.
2. Hangers: Manufacturer's standard rigid, tamper and theft resistant.
3. Size: As indicated on Drawings but not less than 24 inches wide by 30 inches high.
4. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-290.

F. Grab Bars:

1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel with smooth, satin, slip-resistant finish.
3. Outside Diameter: 1-1/2 inches.
4. Configuration and Length: As indicated on Drawings.
5. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-6806 Series.

G. Specimen Pass-Through Cabinet:

1. Description: With self-closing doors on both sides, lock that prevents doors from both being opened at same time, and removable stainless steel tray.

2. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
3. Products: Provide one of the following:

    a. ASI No. 8154.
    b. Bobrick No. B-505.
    c. Bradley No. 9813.

H. Robe Hook – Single Vandal Resistant:

1. Description: Adjustable, single hook, square shaped base with sloped edges and exposed tamper-resistant anchors. Heavy duty hook releases at 40 lb. load.
2. Material: Stainless steel.
3. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.; B-983.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 10 2800

SECTION 12 2413 – ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.
2. Roller Shade Material: Not less than 2 by 3 inches for each color and finish.
3. Installation Accessories: Full-size unit, not less than 10 inches long.
4. Roller Shade: At Architect’s request, provide full-size operating unit, not less than 16 inches wide by 36 long for each type of roller shade indicated.

E. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Product Certificates: For each type of shadeband material.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

D. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Roller Shades: Full-size units equal to 2 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.
2. Drive Chain: Quantity equal to 2 percent of total installed, but not less than 100 lineal feet.
3. Clutch Operator: Quantity equal to 2 percent of total installed, but not less than 2 units.
4. Mounting Brackets: Quantity equal to 2 percent of total installed, but not less than 2 pair.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least 5 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of documented experience.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.10 WARRANTY

A. Warranties: Provide manufacturers' standard warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.

1. Shade Hardware, excluding drive chains: 10 years.
2. Fabric: 10 years.
3. Aluminum and Steel Coatings: One year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Draper, Inc: draperinc.com.
2. Hunter Douglas Architectural: hunterdouglasarchitectural.com.
3. Legrand North America, LLC: legrand.us/solarfective.aspx.
4. Levolor: commercial.levolor.com.
5. Lutron Electronics Co. Inc.: lutron.com
6. MechoShade Systems, LLC: mechoshade.com.

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 ROLLER SHADES, GENERAL

A. Refer to Drawings for roller shade configurations and installation methods, including:

1. Roller shade locations.
2. Shadeband materials.
3. Installation methods.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Single Rollers:

a. Roller Drive-End Location: Right side of interior face of shade unless otherwise indicated on Drawings.
b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.

2. Shadeband-to-Roller Attachment: Adhesive strip or removable spline fitting into integral channel in tube.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

1. Provide mounting hardware as recommended by manufacturer for mounting conditions and substrates indicated on Drawings

D. 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.

1. Provide as indicated on Drawings or as recommended by manufacturer.

E. Shadebands:

1. Single Rollers:

a. Shadeband Material: Light-filtering fabric or light-blocking fabric as indicated.

2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material or exposed with endcaps as standard with manufacturer.

1) For shadebands with light-blocking fabric, provide integral light seal at bottom where hem bar meets the sill.

F. Installation Accessories:

1. For each roller shade provide one of the following in accordance with mounting conditions and details indicated on Drawings

a. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

1) Shape: L-shaped.
2) Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches.

2. For shadebands with light-blocking fabric, provide the following:

a. 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.
b. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.

G. Color and Finish:

1. For metal components exposed to view provide manufacturer's standard clear anodized finish
2. For plastic components exposed to view:

a. Colors: To match clear anodized finish.

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: Nickel-plated metal or stainless steel.

a. Chain Break Strength: 95 pounds, minimum.
b. Loop Length: Full length of roller shade.
c. Limit Stops: Provide upper and lower ball stops.
d. Chain-Retainer Type: Chain tensioner, jamb or sill mounted.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.

a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.

2.4 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric - SC-01: Woven fabric, stain and fade resistant.

1. Product: Subject to compliance with requirements, provide the following:

a. Mermet Corporation: GreenScreen Evolve: www.mermetusa.com.
b. No substitutions.

2. Type: PVC-coated polyester.
3. Performance Requirements:

a. UV Blockage: 95 percent, minimum.
b. Fungal Resistance: No growth when tested according to ASTM G21.

4. Openness Factor: 3 percent.
5. Colors: As indicated in Color Codes and Window Shade Schedule on Drawings.

C. Light-Blocking Fabric - SC-02: Opaque fabric, stain and fade resistant.

1. Product: Subject to compliance with requirements, provide the following:

a. Mermet Corporation: Flocke: www.mermetusa.com.
b. No substitutions.

2. Type: Polyester with acrylic backing.
3. Performance Requirements:

a. UV Blockage: 95 percent, minimum.
b. Fungal Resistance: No growth when tested according to ASTM G21.

4. Openness Factor: 0 percent (Blackout/Room Darkening).
5. Colors: As indicated in Color Codes and Window Shade Schedule on Drawings.

2.5 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows, unless otherwise indicated on Drawings:

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.

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. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances and other conditions affecting performance of the Work.

B. Verify locations of connections to building electrical system for motor-operated roller shades.

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

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Locate so shadeband material is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Roller Shade Locations: As indicated on Drawings.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 12 2413

SECTION 20 0500 – COMMON WORK RESULTS FOR MECHANICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 00 Bidding and Contracting Requirements, and Division 01 General Requirements Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. References
2. Quality Assurance
3. System Description
4. Permits and Fees
5. Examination of Drawings and Premises
6. Substitutions
7. Work Under Other Contracts
8. Submittals
9. Work Restrictions, Coordination, Sequencing and Scheduling
10. Conflicting Requirements and Minor Changes in the Work
11. Delivery, Storage and Handling
12. Basic Electrical Requirements and Methods
13. Interoperability
14. Warranties
15. Mechanical Equipment -General
16. Sealing of Openings (Firestopping)
17. Examination of Existing Conditions and Temporary Services
18. Mechanical Demolition Work
19. Cutting and Patching
20. Protection of Installed Construction, Damage to Other Work and Corrections
21. Chases and Recesses
22. Concrete Work, Equipment Foundations and Supports
23. Coordination with Other Trades
24. Assembly of Equipment, Equipment Connections, Installation and Lubrication
25. Touch-up Painting
26. Scaffolding, Rigging, Hoisting, Excavation and Backfilling
27. Accessibility and Access Panels
28. Field Quality Control, Starting, Adjusting and Commissioning
29. Training and Instruction Program
30. Cleaning and Waste Management

1.3 REFERENCES

A. The mechanical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:

1. AABC - Associated Air Balance Council
2. ANSI - American National Standards Institute
3. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
4. ASTM - American Society for Testing Materials
5. NEC - National Electrical Code
6. NFPA - National Fire Protection Association
7. NEMA - National Electrical Manufacturer’s Association
8. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
9. UL - Underwriters’ Laboratories, Inc.

1.4 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish some of the minimum qualification levels required; Division 01 and individual Specification Sections specify additional requirements.

B. Code Compliance: Work and equipment shall comply with all latest applicable codes and legislations.

C. Regulatory Requirements:

1. Ordinances and Codes: Perform all work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of ASHRAE, NFPA, SMACNA and UL, unless otherwise indicated.

    a. Notify the Architect/Engineer before submitting his proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations. After entering into Contract, make all changes required to conform to above ordinances, rules and regulations without additional expense to the Owner.
    b. Barrier-Free Regulations: Comply with the requirements of the State of Michigan Handicapped Barrier-Free Regulations and with the Americans with Disabilities Act (ADA).

D. 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 required for this Project.

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

F. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

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

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

2. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
3. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

G. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections.

H. 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.

I. Associated Services: Cooperate with agencies performing required commissioning, 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.

J. 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.

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

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect/Engineer will determine which products shall be used at no additional cost to the project.

L. Acceptance of Work: Failure on the part of the A/E to reject shop drawings or to reject Work in progress shall not be interpreted as acceptance of Work not in conformance with Code, Legislation, the Drawings and/or Specifications. Correct Work not in conformance whenever non-conformance is discovered.

1.5 SYSTEM DESCRIPTION

A. Design Requirements: Furnish all labor, materials, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the mechanical systems as specified in the Division 20, 21, 22 and 23 Sections and as indicated on Drawings.

1. The Mechanical Drawings indicate the general design and extent of all equipment, piping and ductwork. Comply with the Drawings as closely as actual construction of the building and the work of other trades permit.

1.6 PERMITS AND FEES

A. Give all necessary notices, obtain all permits; pay all government and state sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the Project scope of work and expenses for permits, licenses, tests and inspections. File all necessary drawings, prepare all documents and obtain all necessary approvals of all governmental and state departments having jurisdiction, obtain all required certificates of inspections for Project scope of work and deliver a copy to the Architect/Engineer before request for acceptance and final payment for the Project scope of work.

1. Upon completion of the Work, obtain and send certificates of inspections and approvals to the Architect/Engineer.

1.7 EXAMINATION OF DRAWINGS AND PREMISES

A. Before submitting Bids, examine the architectural, electrical and other trades' drawings and specifications.

1. Notify Architect/Engineer should any discrepancies occur between them and the mechanical work.
2. No additional charges will be allowed because of failure to make this examination, or to include all materials and labor required for the Work.
3. Before submitting Bids, examine the premises to determine existing conditions for performing the Work. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.

4. The Architectural Drawings take precedence in all matters pertaining to the building structure, Mechanical drawings in all matters pertaining to Mechanical trades and Electrical drawings in all matters pertaining to Electrical trades installation. However, where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer who shall determine the course of action to be taken.

B. Field Measurements:

1. Drawings are not intended to be scaled for roughing-in or to serve as shop drawings. Take all field measurements required for fitting the installation to the building.

1.8 SUBSTITUTIONS

A. Base Bid must be in accordance with materials or products specified. Any exceptions to this must be approved in writing by the Architect/Engineer ten (10) days or more prior to bidding.

1. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the Bid, but will not affect the awarding of the Contract.
2. Mandatory Alternates: The Contractor shall refer to alternates listed in Division 01 and proposals shall submit price quotations for the alternates that apply to the mechanical work.

1.9 WORK UNDER OTHER CONTRACTS

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

B. This Contractor shall be responsible for coordination with piping, equipment, etc., installed in previous Bid Packages. The Contractor shall review the previous bid package drawings and specifications and shall visit the site as part of his/her coordination effort. The Contractor shall also review with the Architect/Engineer, any piping, equipment, and devices that are shown on Bid Package documents but have been purchased and installed under previous bid packages.

1.10 SUBMITTALS

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

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect/Engineer will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
6. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Design Basis: The design has been based on the single manufacturer indicated in the contract documents. The Contractor is responsible for verifying prior to submission, that any other manufacturer even though listed complies with dimensional and performance characteristics of the

base specified product. Modifications shall be made by the Contractor as part of this contract to accommodate changes to the design basis.

2. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
3. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
4. Substitutions: Not allowed.

C. 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.

D. Conditions for Consideration: Architect/Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect/Engineer 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 Architect/Engineers and owners, if requested.
5. Samples, if requested.

E. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

F. Delegated-Design Services:

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

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

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

    a. 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.

G. Submittal Requirements:

1. The following is in addition to the requirements for submittals in Division 01
2. Material List: Submit a complete list of all materials and equipment, and their manufacturers, for approval by the Architect/Engineer within 15 days after award of contract and prior to submittal of shop drawings.

3. All equipment of the same or similar systems shall be by the same manufacturer
4. Shop Drawings: Prepare shop drawings drawn to scale and submit to the Architect/Engineer for review, following submittal requirements listed in Division 01 and as required by the General Conditions. After the shop drawings are reviewed, they will be stamped and returned for distribution.
5. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional Architect/Engineer if specified.

6. Submit shop drawings of all sheet metal ductwork with necessary sections, details, dimensions, etc.

    a. All sheet metal shop drawings shall bear balance agency approval stamp prior to submittal to Architect/Engineer.

7. Submit shop drawings and product data for all equipment, materials, valves, plumbing and heating specialties, pipe hangers, wiring diagrams and control diagrams including but not limited to items indicated below.
8. No apparatus or equipment shall be shipped from stock or fabricated until shop drawings for them have been reviewed by the Architect/Engineer. By the review of shop drawings, the Architect/Engineer does not assume responsibility for actual dimensions or for the fit of completed work in position, nor does such review relieve Mechanical Trades of full responsibility for the proper and correct execution of the work required.
9. Submit shop drawing with all pertinent data and with identification mark number or symbol numbers as specified or scheduled on the Mechanical Drawings.
10. Shop drawings shall be reviewed by the Mechanical Contractor for completeness and accuracy prior to submitting to the Architect/Engineer for review. The shop drawings shall be dated and signed by the Mechanical Contractor prior to submission.
11. Where the shop drawings consist of manufacturer's standard detail drawing or schedules and contain data for a variety of similar equipment, indicate the data pertinent to the equipment furnished for this project only. Standard detail drawings and schedules not clearly indicating which data is associated with this Project shall be returned "Rejected”.
12. Where accessories and/or options are specified and do not appear as part of manufacturer's standard detail drawings, state each accessory that is to be provided with the equipment on the standard detail drawings.
13. Partial submittals for equipment will not be permitted. Where partial submittals are transmitted to the Architect/Engineer, they will be returned "Rejected”.
14. Plumbing fixture submittals shall be submitted as one (1) package including all fixtures intended to be used for this Project.
15. Submittal Preparation: Shop drawing shall be submitted using the IDS “Submittal Form”. Provide one (1) form for each project manual section number. The mechanical contractor shall fill out each submittal following the instructions printed on the back of the submittal form.
16. Submit manufacturer’s submittals on all major mechanical systems and/or equipment, including but not limited to all equipment scheduled on drawings and all equipment in all division 20, 21, 22 and 23 specifications.

1.11 WORK RESTRICTIONS, COORDINATION, SEQUENCING AND SCHEDULING

A. Existing Utility Interruptions: 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:

1. Notify Owner and Architect/Engineer not less than 10 days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's and Architect/Engineer's written permission.

B. Coordination: Each Contractor shall coordinate its construction operations with those of other Contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other Contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. Contractor shall coordinate all final specific utility requirements.

D. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.

E. Sequence and schedule work to avoid interference with the work of other Trades. Be responsible for removing and relocating any work which in the opinion of the Owner's Representatives causes interference.

F. Coordinate mechanical equipment installation with other building components.

G. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

H. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

I. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

J. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

K. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Section 08 3113 “Access Doors and Frames.”

L. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

M. Action may include a request for additional information, in which case time for response will date from time of receipt of additional information.

1.12 CONFLICTING REQUIREMENTS AND MINOR CHANGES IN THE WORK

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

C. Architect/Engineer will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

D. Drawings are diagrammatic, the Contractor shall relocate devices a reasonable distance for coordination.

1. A reasonable distance is 15 feet at no additional cost.

1.13 DELIVERY, STORAGE AND HANDLING

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

B. Storage and Protection: Provide adequate storage space for all mechanical equipment and materials delivered to the job site under a weather protected enclosure. Location of the space will be designated by the Owner’s Representative. Equipment set in place in unprotected areas must be provided with temporary protection.

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. Store cementitious products and materials on elevated platforms.
5. Store foam plastic and plastic piping from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.
9. Be responsible for the care and protection of mechanical equipment until it has been fully tested and accepted.
10. Protect materials with permanent factory finish from damage by covering.
11. Protect materials with enamel or glaze surfaces by covering or coating as recommended in “Handling and Care of Enameled Cast Iron Plumbing Fixtures” bulletin, issued by the Plumbing Fixtures Manufacturers Association and as approved.
12. Coat polished or plated metal parts with white petroleum jelly immediately after installation.
13. Protect equipment outlets, pipe and duct openings with temporary plugs or caps.
14. Care and protection of electrical equipment furnished by Mechanical Trades and installed by Electrical Trades shall be the responsibility of the Electrical Trades after receiving equipment from Mechanical.

1.14 BASIC ELECTRICAL REQUIREMENTS AND METHODS

A. For Electrical Work provided in Division 20, 21, 22 and 23 Sections, furnish UL Listed components, in accordance with Division 26 and applicable NEMA and NEC (ANSI C 1) requirements. Provide wiring, external to electrical enclosures, in conduit. All electrical work provided by this Contractor shall conform to Division 26 requirements.

B. Changes Involving Electrical Work: The design of the mechanical systems is based on the equipment specified and scheduled on the Drawings.

1. Where equipment changes are made that involve additional electrical work (larger size motors, additional wiring of equipment, etc.) the Mechanical trades involved shall compensate the electrical trades for the cost of the additional Work required.

C. Heat-producing or spark-generating electrical devices located within Class I, Division I, Group D areas and Class I, Division II, Group D areas shall bear UL Label rated for the exposure.

D. For equipment specified in Divisions 20, 21, 22 and 23 and provided with electrical characteristics requirements other than that specified or indicated, include necessary electrical wiring, components and transformer equipment selected to assure maximum efficiency operation.

E. Provide specialty instrument wiring necessary to operation of a component, assembly or system as part of the work in Divisions 20, 21, 22 and 23.

F. Coordinate the number of auxiliary N.O. and N.C. contacts to be provided as part of the Work to accommodate equipment and functions specified or indicated as part of the work under these Sections.

G. Provide electrical work required for the operation of components and assemblies provided as part of the Work in Division 20, 21, 22 and 23 Sections but not specified or indicated as part of the Work in Division 26.

H. Where “packaged” equipment is specified, one or more power supplies and interconnecting control wiring may be required to provide a complete, operating unit. Any required intercomponent and interassembly power or control wiring shall be provided as part of the Work of Divisions 20, 21, 22 and 23 per the applicable requirements of Division 26.

I. Mount line voltage (120 VAC) control components specified as part of the Work under Division 20, 21, 22 and 23 Sections for connection as part of the work under Division 26.

J. Refer to Electrical Drawings and Division 26 for specific information regarding provisions for and arrangement of electrical circuits and components and for interface with Work specified under Divisions 20, 21, 22 and 23.

1.15 INTEROPERABILITY

A. Contractor shall review all Drawings and Specifications from all Mechanical and Electrical disciplines and shall coordinate work as necessary to ensure proper coordination and interoperability of all existing and new, networked or interconnected systems, as indicated. Networked/interconnected systems may include, but are not limited to the following:

1. DDC controls provided by the Mechanical Systems Controls Contractor
2. Packaged mechanical unit controls provided by the unit Manufacturer
3. Lighting controls provided by the Electrical Contractor
4. Fire Alarm systems provided by the Electrical Contractor
5. Audio/Visual systems provided by the Electrical Contractor
6. Security systems provided by the Electrical Contractor
7. Site central Operator Interface system

1.16 WARRANTIES

A. Warranty: Warranty the mechanical installation to be free from defects and replace or repair, to the satisfaction of the Owner, any part of the mechanical installation which may fail within a period of one year after substantial completion, provided that such failure is due to defects in materials or workmanship or to failure to follow the Contract Documents.

1. File with the Owner any and all warranties from equipment manufacturers and what operating conditions and performance capacities they are based on. Refer to Division 01 Sections.
2. During this warranty period, correct or replace all defects developing through materials or workmanship immediately as directed by the Architect/Engineer without expense to the Owner; make all such repairs or replacements to the Owner's satisfaction

B. 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.

C. Warranty Start Date: Date of substantial completion.

PART 2 - PRODUCTS

2.1 MECHANICAL EQUIPMENT – GENERAL

A. All major items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment and shall be the manufacturer's latest design.

2.2 SEALING OF OPENINGS (FIRESTOPPING)

A. Seal openings around pipes in sleeves and around duct openings through walls, floors and ceilings, and where floors, fire rated walls and smoke barriers are penetrated. (Fiberglass is not acceptable.) Fire and/or smoke barriers shall be UL listed fire and smoke stop fittings and shall have fire rating equal to or greater than the penetrated barrier. Refer to Division 07 Section "Firestop Systems" for additional requirements.

1. Manufacturers:

a. 3M
b. Hilti
c. Tremco
d. Manville

PART 3 - EXECUTION

3.1 EXAMINATION OF EXISTING CONDITIONS AND TEMPORARY SERVICES

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

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

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

B. Acceptance of Conditions: Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Project scope of work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

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, submit a request for information to Architect/Engineer. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

F. Provide temporary water and heat service as described in Division 01.

G. New equipment installed shall not be used for temporary construction use without prior written approval from Owner's representative.

3.2 MECHANICAL DEMOLITION WORK

A. General: Perform mechanical demolition work in a systematic manner. Use such methods as outlined below to complete Work indicated on Drawings.

B. Obtain approval from the Owner prior to interrupting existing services. All service interruptions shall be at a time suitable to the Owner. Where the Owner approves service interruptions at times resulting in premium tile work to this Contractor, this Contractor shall include the premium time in his Base Bid.

C. Remove existing mechanical equipment, components and materials, including but not limited to piping, air handling units, heating units, plumbing fixtures, pumps, supports and other mechanical items made obsolete by the new work.

1. Where existing equipment is removed, piping shall be capped under floor or behind face of wall.

D. Work indicated to be removed includes removal of all auxiliary materials, accessories, anchorage, fasteners, and etc., down to bare substrate. No residual materials shall remain from work to be removed. Contractor will use whatever means necessary; including removal of all materials attached or related to those items designated to be removed, as acceptable to Owner and Architect/Engineer, to provided complete and thorough removal of existing work.

E. Protect existing equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

F. Work that has been cut or partially removed shall be protected against damage.

G. Materials salvaged from this work shall not be reused except where reuse is specifically indicated.

H. Existing fixtures and mechanical equipment removed, not reused and not specifically indicated to be turned over to the Owner shall be legally and properly disposed of off Owner's property.

I. Existing fixtures and mechanical equipment specifically indicated to be turned over to the Owner shall be carefully disconnected, removed and turned over to the Owner in a storage area as directed by the Owner.

J. Accessible Work: Remove exposed equipment and installations, indicated to be demolished, in their entirety.

K. Abandoned Work: Cut and remove buried MEP system materials, equipment, raceways, piping and distribution, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap and patch surface to match existing finish.

L. Remove demolished materials from Project site.

M. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

N. Field verify all existing MEP system materials, equipment, raceways, piping and distribution to be removed for exact quantities.

O. Remove all existing MEP system materials, equipment, raceways, piping and distribution located above ceilings and in walls that are not being reused.

P. Remove all MEP systems and appurtenances, which are to be removed, in their entireties back to the source or source panels.

Q. Remove all existing MEP system materials, equipment, raceways, piping and distribution located in walls or ceilings being demolished. Abandon no devices that have been disconnected unless specifically noted.

R. Maintain continuity of all existing MEP devices, and utilization equipment not removed.

S. Remove, store, protect, and reinstall existing work as required to accommodate alteration indicated.

T. The existing work to be removed, in general, is as indicated on the Drawings and in this Section, but also includes any materials or work necessary to permit installation of new materials, as approved by Owner and Architect/Engineer.

U. If systems, equipment, and components to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

V. In finished areas, all systems, equipment, and components shall be cut back to a concealed location, i.e., within walls, above ceilings, etc., before capping.

3.3 CUTTING AND PATCHING

A. See Division 01 for additional requirements. The Contractor shall furnish sketches showing the location and sizes of all openings, chases, etc., required for the installation of Work.

B. Work under this Division shall include furnishing, locating and setting inserts and/or sleeves required before the floors and walls are built or be responsible for cutting, drilling or chopping where sleeves and inserts were not installed, where wall or floors are existing or not correctly located. The Contractor shall do all drilling required for the installation of hangers.

C. Exercise extreme caution when core drilling or punching openings in concrete floor slabs in order to avoid cutting or damaging structural members. No structural members or structural slabs/floors shall be cut without the written acceptance of the Structural Engineer and all such cutting shall be done in a manner directed by him.

D. The drilling or punching of structural members, such as holes through beams or columns, shall not be done without the specific permission of the Architect/Engineer.

E. Cutting of holes through floors and walls shall be done only at such locations as may be directed by the Architect/Engineer.

F. Cooperate with the other Contractors so that all cutting and repairing in any given area will be done simultaneously.

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

3.4 PROTECTION OF INSTALLED CONSTRUCTION, DAMAGE TO OTHER WORK AND CORRECTIONS

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.

C. Protect all mechanical equipment, ductwork and piping from dust, dirt and debris throughout construction

D. Remove debris from concealed spaces before enclosing the space.

E. Remove liquid spills promptly.

F. Where dust would impair proper execution of the Project scope of work, broom-clean or vacuum the entire work area, as appropriate.

G. Installed Work: Keep installed work clean.

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

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.

L. Mechanical Trades will be responsible for all damage to other Work caused by their Work or through the neglect of their workers.

1. All patching and repairing of any such damaged Work shall be performed by the trades that installed the Work, but the cost shall be paid by the Mechanical Trades.

M. The cost of corrective work shall be included under the contract.

N. Repair or remove and replace defective construction.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

O. Restore permanent facilities used during construction to their specified or original condition.

P. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

Q. Repair components that do not operate properly. Remove and replace operating components to new condition.

R. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

3.5 CHASES AND RECESSES

A. Provide sizes and locations of chases and recesses affecting the mechanical work for provision by general trades.

3.6 CONCRETE WORK, EQUIPMENT FOUNDATIONS AND SUPPORTS

A. Concrete bases shall be provided by Architectural Trades, the correct size and location shall be by Mechanical Trades. Mechanical Trades shall furnish and locate anchor bolts and sleeves, for installation by Architectural Trades.

B. Coordinate with Architectural Trades any concrete work required for the mechanical installation. Concrete work shall include housekeeping pads beneath equipment and vibration isolation bases. Concrete work shall be in conformance with Division 03 Specifications.

C. Furnish foundations and supports for mechanical equipment and materials as required by codes, as listed hereinafter and shown or noted on the Drawings.

D. Provide necessary inserts, rod, structural steel frames, brackets, platforms, etc., for equipment suspended from ceilings or walls.

E. Inserts for equipment support shall be lead shield anchors for small work and expansion shields for large work. Wooden plugs will not be allowed. Do not use metal roof decking and cellular floors for supporting equipment.

3.7 COORDINATION WITH OTHER TRADES

A. Install Work so as to avoid interferences with the Work of other trades. Be responsible for removing and relocating any work that, in the opinion of the Owner’s Representative, causes interferences.

B. Should construction conditions prevent the installation of mechanical equipment at locations shown on the drawings, minor deviations may be permitted and shall be as directed by the Architect/Engineer and shall be made without additional cost to Owner.

3.8 ASSEMBLY OF EQUIPMENT, EQUIPMENT CONNECTIONS, INSTALLATION AND LUBRICATION

A. The Contract Drawings and Specifications indicate items to be purchased and installed which are noted by a manufacturer's name, catalog number and/or brief description.

B. The catalog number may not designate all the accessory parts and appurtenances required for the particular use or function.

C. Arrange with the manufacturer for the purchase of all items required for the complete installation and efficient operation.

D. Connections to equipment, fixtures, etc., shall be made in accordance with the shop drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. Any and all additional connections not shown on the Drawings but called for by the equipment manufacturer's shop drawings or required for the successful operation of the particular equipment furnished shall be installed as part of this Contract at no additional charge to the Owner.

E. All fittings connecting to equipment on piping 2-1/2 inches and above in size, shall be flanged, standard weight pattern with flat machine face provided with ring gaskets.

F. All fittings connecting to equipment on piping 2 inches and below in size, shall be made with unions.

G. All piping connections to pumps and other equipment shall be installed without strain at the pipe connection of the equipment.

1. When directed, remove the bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected.

H. Brass couplings shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

I. 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.
4. Maintain minimum headroom clearance as indicated by Architect/Engineer in spaces without a suspended ceiling.

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

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

L. 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.

M. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels.

N. 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.

O. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. All equipment and piping not supported from the building structural steel shall not exceed a combined load of 7 psf when supported from the metal deck/slab. Any condition that may exceed this limit shall be reviewed and approved by the Architect/Engineer and Structural Engineer before installation.
2. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect/Engineer and/or to allow for proper access.
3. Allow for building movement, including thermal expansion and contraction.
4. 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.

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

Q. Provide all oil for the operation of the equipment until substantial completion. Contractor shall be held responsible for all damage to bearings while the equipment is being operated by him up to the date of acceptance of the equipment. Protect all bearings and shafts during installation and thoroughly grease the steel shafts to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction.

3.9 TOUCH-UP PAINTING

A. In general, no painting is required by Mechanical Trades other than touch-up of factory-finished mechanical equipment.

B. All factory finished mechanical equipment shall be cleaned at completion of the job. Equipment showing rust or mars shall be thoroughly cleaned and sanded, prime coated and touched up with enamel of color to match original finish.

3.10 SCAFFOLDING, RIGGING, HOISTING, EXCAVATION AND BACKFILLING

A. Coordinate with Architectural Trades any concrete work required for the mechanical installation. Concrete work shall include housekeeping pads beneath equipment and vibration isolation bases. Concrete work shall be in conformance with Division 03 Specifications.

B. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises any equipment and apparatus furnished under this Division. Remove same from premises when no longer required.

C. It is the responsibility of the Contractor to coordinate sizes, depths, fill and bedding requirements and any other excavation work required under this Division.

D. Furnish excavating and backfilling to install work specified in the Mechanical Division. Refer to Mechanical Drawings and Division 31 Section “Earthwork” for methods and materials.

E. Provide all pumping and well pointing required to keep mechanical excavations dry.

3.11 ACCESSIBILITY AND ACCESS PANELS

A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate thickness of partitions, and the adequate clearance in double partitions and hung ceilings for the proper installation of the Work.

B. Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Access doors shall be furnished for accessibility. Minor deviations from the Drawings may be made to allow better accessibility, but changes of magnitude or which involve extra cost shall not be made without the acceptance of the Architect/Engineer.

C. Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Equipment shall include, but not be limited to: motors, controllers, coil, valves, switchgear, drain points, etc. Access doors shall be furnished if required for better accessibility. Minor deviations from the Drawings may be made to allow better accessibility, but changes of magnitude or which involve extra cost shall not be made without the acceptance of the Architect/Engineer.

D. Furnish access doors as required to make accessible all valves, controls, coils, motors, air vents, filters, motorized dampers, electrical boxes and other equipment installed by Mechanical trades or as required by Code. Refer to Division 08 for the type of access doors required. Refer to drawings and specifications for the type of access door to be provided at the outside air intake duct.

E. Access doors in walls, ceilings, floors, etc., shall be field coordinated. It is the responsibility of the Contractor to coordinate and provide information regarding the sizes and quantities of access doors required for his work. The Contractor shall arrange his work in such a manner as to minimize the quantity of access doors required, such as grouping shutoff valves in the same area. Where possible, locate valves in already accessible areas, such as lay-in ceilings, etc.

F. On a clean set of prints, the Contractor shall mark in red pencil the location of each required access door, including its size and fire rating (if any), and shall submit the print to the Architect/Engineer for review before access doors are purchased or installed.

G. Upon completion of the Project, the Contractor shall physically demonstrate that all equipment and devices installed have been located and/or provided with adequate access panels for repair, maintenance and/or operation. Any equipment not so furnished shall be relocated or provided with additional access panels by the installing Contractor at no additional cost to the Owner.

3.12 FIELD QUALITY CONTROL, STARTING, ADJUSTING AND COMMISSIONING

A. Tests and Inspection: When the systems are completed, operate equipment as directed by Architect/Engineer. Replace all faulty equipment. Make necessary adjustments before final acceptance.

1. Perform all tests required by State, City, County and/or other agencies having jurisdiction.
2. Provide all materials, equipment, etc., and labor required for tests.

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

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

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: Provide a factory-authorized service representative to inspect field-assembled components and equipment installation, comply with qualification requirements in "Quality Requirements."

F. Perform the commissioning activities as outlined in the Division 01 Section “Commissioning” and other requirements of the Contract Documents.

G. Each Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings held on a weekly basis.
4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review and accept construction checklists provided by the CxA.
6. Complete paper or electronic construction checklists as Work is completed and provide to the Commissioning Authority on a weekly basis.
7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

H. Refer to related information in other sections for additional requirements.

I. Maintenance Materials: Retain all portable and detachable portions of the installation such as keys, tools, manuals, etc., until the completion of the work and then them over to the Owner and obtain itemized receipt. This receipt shall be attached to the "Final Application" for payment.

3.13 TRAINING AND INSTRUCTION PROGRAM

A. Program Structure: In addition to Division 01 and individual section requirements, develop an instruction program that includes individual training modules for each system and equipment not part of a system.

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. Provide instruction for the following modules.

1. Basis of System Design and Operational Requirements
2. Documentation
3. Emergencies
4. Adjustments
5. Troubleshooting
6. Maintenance
7. Repairs

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

D. Video Record: Training shall be recorded as digital video.

3.14 CLEANING AND WASTE MANAGEMENT

A. Keep premises free from accumulation of waste materials and rubbish. At completion of work remove all rubbish from and about the building and leave the mechanical systems clean and ready for use.

B. Close and tightly seal all partly used containers and store protected in well-ventilated, fire-safe area at moderate temperature. Deliver to reuse and/or recycle facilities if not removed from site for Contractor’s reuse.

C. Separate and recycle waste materials in accordance with the Waste Management Plan and to the maximum extent possible.

D. Separate metal waste, packaging, and all other materials in accordance with the Waste Management Plan and place in designated areas for recycling or reuse.

E. Check with manufacturer for recycling options. Most manufacturers take back scrap and unused portions for resale or manufacturing into new product.

END OF SECTION 20 0500

SECTION 20 0513 – COMMON MOTOR REQUIREMENTS FOR MECHANICAL

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 general requirements for single-phase and three-phase, general-purpose, horizontal, small and medium, squirrel-cage induction motors and single-phase, fan/pump-duty, horizontal, small and medium, electronically commutated, permanent magnet (EC) motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 DEFINITIONS

A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.

B. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

1.4 SUBMITTALS

A. Product Data for Field-Installed Motors: For each type and size of motor, provide nameplate data and ratings; shipping, installed, and operating weights; mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.

B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:

1. Each installed unit's type and details.
2. Complete NEMA nameplate electrical data including design type, insulation, service factor, and efficiency
3. Diagrams of power and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.
4. Bearing type, L10 life, and seal construction (open, single, or double shielded).
5. Certification that electronic VFD driven motors comply with NEMA MG-1 Part 31.
6. Ground ring and ceramic bearing details as applicable

C. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around field-installed motors. Show motor layout, mechanical power transfer link, driven load, and relationship between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

D. Test Reports: Written reports from testing procedures outlined in Part 3.

E. Operation and Maintenance Data: For field-installed motors to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the following quality assurance standards; latest editions, unless noted otherwise:

1. NFPA 70: National Electrical Code.
2. NEMA Standards Publication MG 1 (2011): Motors and Generators.
3. ABMA 9: American Bearings Manufacturers Association, Load Ratings and Fatigue Life for Ball Bearings
4. UL 1004: Motors, Electric

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain field-installed motors of a single type through one source from a single manufacturer.

D. Product Options for Field-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors and are based on the specific system indicated.

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.

F. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:

1. Compatible with the following:

a. Motor controllers
b. Magnetic controllers
c. Multispeed controllers
d. Reduced-voltage controllers

2. Designed and labeled for use with variable frequency drives as applicable, and suitable for use throughout speed range without overheating.
3. Matched to torque and horsepower requirements of the load.
4. Matched to ratings and characteristics of supply circuit and required control sequence.
5. Ambient and environmental conditions of installation location

B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.

C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products of the following manufacturers:

1. Reliance Electric
2. Baldor Electric Company
3. General Electric
4. U. S. Electric Motors

5. Marathon Electric
6. Toshiba Corp

2.2 MOTOR GENERAL REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Motor requirements apply to factory-installed and field-installed motors except as follows:

1. Different ratings, performance, or characteristics for a motor are specified in another Section.
2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.
3. Motor Connections: Multiple power connections not allowed.

C. Motors Less Than 1/2 HP: Single-phase

D. Motors 1/2 HP and Larger: Three-phase.

E. Frequency Rating: 60 Hz, alternating current.

F. Voltage rating of motor shall be determined by voltage of circuit to which motor is connected:

1. 120 V Circuit: 115 V motor rating.
2. 208 V Circuit: 200 V motor rating.
3. 240 V Circuit: 230 V motor rating.
4. 480 V Circuit: 460 V motor rating.

G. Service Factor: 1.15 for open drip-proof motors; 1.0 for totally enclosed motors and inverter duty motors.

H. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3,300 feet above sea level.

I. 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.

J. Motors shall be NEMA Design B.

K. Provide Class B insulation, unless noted otherwise.

L. All disconnects and other electrical accessories shall comply with Division 26 requirements

M. Motors shall be nominal 1,800 rpm, unless noted otherwise.

2.3 SINGLE-PHASE MOTORS

A. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

B. Use shaded pole motors only for motors smaller than 1/20 HP.

C. Provide automatic reset type thermal over-load protection.

D. Bearings: Sealed or regreasable ball or sleeve bearings, suitable for the radial and thrust loading of the application.

E. Furnish with sliding base/slotted mounting holes adequate for proper belt tensioning and alignment of motor or motor/load.

F. Nameplates may be printed-type glued to the motor.

2.4 SINGLE-PHASE EC MOTORS

A. Motors equal to or smaller than 1 HP shall be Electronically Commutated (EC) type, to suit starting torque and requirements of specific motor applications.

B. Bearings: Pre-lubricated, antifriction ball bearings suitable for radial and thrust loading.

C. Motors: Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20 percent of full speed (80 percent turndown). Motor shall be a minimum of 85 percent efficient at all speeds.

1. Variable speed, 0 - 2,000 RPM.
2. Adjustable delay profile.
3. 0 - 10 volt input signal.
4. Output signal.
5. Programmable ramp rate.
6. Soft start.
7. Remote controller.
8. Moisture resistant.
9. Insulation: Class H.
10. Enclosure: Class 2, IP44.
11. Integrated motor protection (electronically protected).
12. UL 778, 1004-1, 508C.
13. CAN/CSA C22.2 #108, #100, #107.1.
14. EMC (89/366 EEC): EN 61000.
15. LVD (73/23/EC): EN 60335-1, EN 60335-2-51.
16. Machine Safety (98/37/EC): EN ISO 12100.

2.5 THREE-PHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor

B. Enclosure: Open Drip Proof (ODP) unless noted otherwise in equipment specifications or schedules, and as suitable for service and application.

C. Motor Efficiency: Nominal (nameplate) full load efficiency and corresponding minimum efficiency shall be equal to or greater than that stated in NEMA MG-1 (2011) Table 12-12 – Full Load Efficiencies of 60hz NEMA Premium Efficient Electric Motors - 600 volts or Less.

1. “Premium Efficient” for all motors 1 hp and larger, including those furnished as part of equipment specified in equipment sections. The Contractor shall confirm utility company minimum requirements for incentive programs and provide motors with efficiencies that meet or exceed the most stringent between NEMA MG-1 and utility company incentive program requirements. The Contractor, at no extra charge to the Owner, shall replace any motor that does not meet the utility company’s incentive program. The efficiency and/or “NEMA Premium Efficiency” shall be displayed on the motor nameplate and clearly indicated on the equipment shop drawings submitted for approval.

D. Motors less than 3 HP**:** Steel or cast iron motor frames, cast aluminum, cast iron, or steel end plates, steel or cast iron terminal box, copper windings. Motor nameplates shall be steel, engraved-type, riveted to motor.

1. Bearings: Regreasable with relief plugs, pre-lubricated ball bearings suitable for radial and thrust loading of the application, with grease fittings, selected for a minimum L-10 bearing life of 26,280 hours, for belted and direct drive.

E. Motors 3 HP and above: cast iron motor frame and mounting feet, cast iron end plates (bells), steel or cast iron terminal box, copper windings. Motor nameplates shall be stainless steel engraved type, riveted to the motor.

1. Bearings shall be regreasable with relief plugs, pre-lubricated ball bearings suitable for radial and thrust loading of the application, with grease fittings. Rated for an L-10 life of 40,000 hours (belted) or 130,000 hours (direct connected).

F. Bearing life calculations shall be per ABMA 9, and for belted applications shall be based on the maximum external side load limits for belted applications per NEMA MG-1 Table 14-1A. L-10 life calculations for vertical motors and horizontal motors mounted in the vertical position shall consider the application's thrust loading.

G. TEFC motors shall also include an external shaft slinger on drive end.

H. Multispeed Motors: Variable torque.

1. Separate windings shall be provided for each speed

I. Stator: Copper windings.

J. Rotor: Random-wound, squirrel cage.

K. Temperature Rise: Match insulation rating.

L. Insulation: Class F.

M. 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.

N. Motors shall not exceed dBA levels listed in NEMA MG-1 54 PART 9 Tables 9-1 and 9-3, at all speeds.

O. Motors shall be suitable for continuous duty at rated horsepower, with a maximum hot spot temperature that does not exceed the temperature limit of the insulation, when operated in an ambient temperature of 40 degrees C, except as otherwise indicated.

P. Direct connected motors shall be furnished with adjustable base. Motors connected to driven equipment by belt or shaft shall be furnished with adjustable NEMA foundation sliding bases.

Q. 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.

R. For motors used with variable frequency drives, provide General Purpose NEMA Premium Efficiency Class motors complying with NEMA MG-1 Part 30 with windings that meet the requirements of NEMA MG-1 Part 31.4.4.2 and with minimum insulation of Class F.

1. For all PWM VFD driven motors up to 100 HP: Provide a maintenance free, circumferential conductive micro fiber grounding ring installed on the AC motor to discharge shaft currents to ground. Grounding ring shall be AEGIS SGR (Shaft Grounding Ring).
2. Motors protected by the AEGIS SGR shall be warranted for the term of the manufacturer's motor warranty from induced bearing current damage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in of conduit systems to verify actual locations of conduit connections before motor installation.

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

3.2 MOTOR INSTALLATION

A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.

B. Comply with mounting and anchoring requirements specified in Section 20 0548 "Vibration Controls for Mechanical."

3.3 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
2. Test interlocks and control features for proper operation.
3. Verify that current in each phase is within nameplate rating.

B. Testing: Owner shall engage a qualified testing agency to perform the following field quality-control testing should the proper performance of the motor be in question. If motor performance is found to be deficient, Contractor shall replace motor at no cost to Owner.

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.4 ADJUSTING

A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

B. Verify that bearings are factory lubricated before starting motors. Lubricate per manufacturer’s instructions. Do not over-lubricate bearings.

C. Check motors for unusual heating, noise, or excess vibration during operation. Correct any such deficiencies.

1. Any motors with vibration exceeding specified limits, as noted in the Testing, Adjusting and Balancing Section, or manufacturer's recommendations, whichever is more stringent, shall be corrected, at no cost to Owner, until reduced below those limits.

3.5 MOTOR CLEANING

A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean motors, on completion of installation, according to manufacturer's written instructions.

3.6 MOTORS USED WITH VARIABLE FREQUENCY DRIVES

A. Install shaft grounding rings on all equipment motors using variable speed drives.

B. Install per manufacturer's instructions.

C. Assure grounding of SGR to motor frame.

END OF SECTION 20 0513

SECTION 20 0523 – VALVES

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. Provide valves as scheduled and specified in this Section for the following systems:

1. Domestic Cold Water, Hot Water, Hot Water Return
2. Heating Hot Water and Non-Potable Water
3. Other similar piping systems except where specialty valves are specified under other sections

1.3 QUALITY ASSURANCE

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the specified quality assurance standards; latest editions, unless noted otherwise.

1. National Sanitation Foundation NSF/ANSI-61, including Annex G (listed as ≤ 0.25% weighted average lead content) (and/or NSF/ANSI-372) and Annex F. Applies to any item in contact with domestic (potable) water.
2. US Safe Drinking Water Act (any item in contact with domestic (potable) water).

1.4 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. SWP: Steam working pressure.
6. TFE: Tetrafluoroethylene plastic.

1.5 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; shipping, installed, and operating weights; furnished specialties; and accessories.

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 GENERAL VALVE REQUIREMENTS

A. All valves shall have bodies, seats, stem seals and disc materials compatible with intended fluid, temperature, pressure and service.

B. Valve Pressure and Temperature Ratings: Unless noted otherwise, valves shall be rated for a minimum of 125# WSP (working steam pressure)/ 250# WOG (cold water, oil, gas).

C. Unless noted otherwise, valves through 2" shall have screwed connections for steel piping and sweat connections for copper piping. Domestic cold water, hot water and hot water return shall have sweat connections (lead free); valves 2-1/2" and larger shall be flanged.

D. Valves in contact with domestic (potable) water shall be “lead free” NSF/ANSI-61 Annex G (and/or NSF/ANSI-372) labeled.

E. All EPDM shall be peroxide cured. All wetted seals shall be made from materials that are immune from chloramine degradation.

F. Manually operated valves 4" and larger installed 10 feet above finished floor or higher, shall have chain wheel operators. Chain shall reach to within 7'-0" of floor or operating platform, or within two feet of accessible ceiling.

G. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

H. Provide extended valve stems for insulated piping.

I. Where the valves are installed outdoors, all components including the gear operated wheel operators shall be weatherproofed.

J. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

K. Valve Bypass and Drain Connections: MSS SP-45.

L. Solder Joint: With sockets according to ASME B16.18.

1. Caution: Use solder with melting point below 840 deg F for angle, check, and globe valves; below 421 deg F for ball valves.

M. Threaded: With threads according to ASME B1.20.1.

2.2 BALL VALVE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Apollo
2. Milwaukee
3. NIBCO
4. Watts
5. Bonomi
6. Jomar

B. Two-piece, full port, bronze body, stainless steel ball and stem:

1. Description:

a. Standard: MSS SP-110
b. SWP Rating: 150 psig
c. CWP Rating: 600 psig
d. Body Design: Two Piece
e. Body Material: Bronze
f. Ends: Threaded
g. Seats: PTFE or TFE
h. Stem: Stainless Steel
i. Ball: Stainless Steel, vented
j. Port: Full
k. Handle: Plastic Coated Lever
l. Locking Device: When Noted on Drawings
m. Approvals: UL or CSA for Natural Gas Service

2.3 SILENT CHECK VALVE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wafer Style:

a. Milwaukee - Series 1400
b. APCO - Series 300
c. Mueller
d. Metraflex
e. Titan Flow Control, Inc.

2. Globe Style:

a. Milwaukee
b. APCO
c. Mueller
d. Metraflex
e. Apollo
f. Titan Flow Control, Inc.

B. Spring loaded type check valve, stainless steel spring, iron body and bronze trim

2.4 DRAIN VALVE

A. General Service: Ball valve with 3/4-inch hose threaded end fitting and cap.

2.5 MANUAL BALANCING VALVE

A. General Manual Balancing Valve Requirements:

1. Provide ports for measuring flow, memory stop, bubble tight shut-off, valve Cv characteristics suitable for throttling.
2. Size valve to produce readable design flow and maximum full open pressure drop of 3 feet.
3. Ensure NSF 61 compliance for balance valves used in domestic (potable) water systems

B. Through 2": brass body, brass or stainless steel ball or brass disc or plug, calibrated.

1. Manufacturers:

a. Bell & Gossett Circuit Setter Plus
b. Armstrong
c. IMI Flow Design Accusetter
d. Taco
e. Victaulic

PART 3 - EXECUTION

3.1 VALVE APPLICATION SCHEDULE

A. Domestic Cold Water/Hot Water/Hot Water Return Systems:

1. Isolation through 2": Ball Valve
2. Isolation 2-1/2" and Larger: Butterfly Valve NSF 61 Compliant
3. Main Service Water Valve at Building Entrance: High Performance Butterfly Valve NSF 61 Compliant
4. Check 2-1/2” and Larger: Silent Check Valve
5. Balancing: Manual Balancing Valve

B. Heating Hot Water/Non-Potable Water Systems:

1. Isolation through 2": Ball Valve.
2. Isolation 2-1/2" and Larger: Butterfly Valve.
3. Check through 2”: Swing Check Valve
4. Check 2-1/2” and Larger: Silent Check Valve
5. Balancing: Manual Balancing Valve

C. Valves for Mechanical Press Fit Piping Systems:

1. The mechanical press fit system manufacturer’s standard isolation ball valves through 2” shall be allowed provided they meet the ball valve specification in Section 2 above.

3.2 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance. 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.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 20, 21, 22 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves such that operator is completely operable, and the valve position indicator is discernible from the floor.

C. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

D. Locate valves for easy access and provide separate support where necessary.

E. Provide branch isolation valves at all branch piping take-offs from main headers whether specifically indicated on the drawings or not. This pertains to all piping systems.

F. Install valves in horizontal piping with stem at or above center of pipe.

G. Install valves in position to allow full stem movement.

H. Domestic Hot Water Valve Installation:

1. For general service applications: steam and condensate flanged valves shall be installed with Flexitallic gaskets, 316L stainless steel, with “Flexicarb” filler.
2. For general service applications, domestic hot water flanged valves shall be installed with 100% PTFE gaskets, Interlex SQ-S.

END OF SECTION 20 0523

SECTION 20 0553 – MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide Mechanical system identification for piping, valves, ductwork, architectural access panels and equipment.

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.4 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.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Company
2. Brimer
3. Craftmark
4. MSI (Marking Services Incorporated)
5. Seton Name Plate Corporation

2.2 PIPE MARKERS

A. Manufacturer's standard, pre-printed, color-coded, plastic pipe markers, complying with ANSI A13.1, and requirements below. Self-adhesive markers are not acceptable.

B. For pipe diameter (with insulation) less than 6": full-band, semi-rigid, snap-on pipe markers, extending 360 degrees around pipe.

C. For pipe diameter (with insulation) of 6" and larger: full-band or strip-type pipe markers, but not narrower than 3 times letter height. Fasten with nylon or stainless steel bands for pipe 6" through 12". Fastened with stainless steel bands for piping over 12".

D. Lettering: Standard nomenclature which best describes piping system, as selected by Engineer (in cases of variance from table below).

E. Arrows: Pipe marker arrows indicating direction of flow, either integrally with piping system lettering, or as a separate marker.

F. Identify contents of piping by both fluid contained and unique temperature and /or pressure (if necessary, to distinguish between other systems with same fluid at different conditions); e.g. Potable Hot Water - 110F vs Potable Hot Water – 140F

G. Use the following color coding and nomenclature for pipe markers:

	Piping System	Label I.D.	Letter and Label Color
1.	Cold Water, Domestic	CW	White on Green
2.	Compressed Air	CA	White on Blue
3.	Fire Protection	FP	White on Red
4.	Hot Water, Domestic	HW	White on Green
5.	Hot Water Return, Domestic	HWR	White on Green
6.	Natural Gas	G	Black on Yellow
7.	Non-Potable Water	NPW	White on Green
8.	Sanitary Vent	V	White on Green
9.	Sanitary Waste	SAN	White on Green
10.	Storm Sewer Water	ST	White on Green
11.	Condensate Drain	COND	White on Green
12.	Hot Water Heating Supply	HWHS	White on Green
13.	Hot Water Heating Return	HWHR	White on Green

H. Underground Pipe Markers: Manufacturer's standard, permanent, bright-colored plastic tape, intended for direct-burial service, 6" wide x 4 mils thick, continuously printed to indicate service of buried pipe. For plastic pipe, provide label with detectable nonferrous locator.

2.3 DUCT MARKERS

A. Plastic, adhesive type color-coded duct markers, with arrow indicating direction of flow, and with fan system identified. Conform to the following color code and nomenclature:

	Service/Duct	Label I.D.	Letter and Label Color
1.	Supply Air (Eqpt #)	SA (Eqpt. #)	White on Green
2.	Return Air (Eqpt #)	RA (Eqpt #)	White on Blue
3.	Exhaust Air (Eqpt #)	EA (Eqpt #)	Black on Yellow
4.	Outdoor Air (Eqpt #)	OA (Eqpt #)	White on Blue
5.	Relief Air (Eqpt #)	RLF (Eqpt #)	White on Blue

B. Provide plastic adhesive duct access door markers indicating item and associated equipment accessed, and appropriate safety and procedural information. (eg. Fire Damper AHU-1)

2.4 EQUIPMENT MARKERS

A. Engraved plastic equipment markers for all scheduled equipment, (eg., chillers, pumps, air handling units, heat exchangers, fans, etc.). Indicate equipment mark and service, (eg. EF-1 Serving Toilet Rms 2035 & 2036; CHWP-1 Serving CH-1; AHU-1 Serving Flr 1 Offices) nominal capacity (tons, cfm or gpm). Scale marker and lettering to equipment labeled. White lettering on black background.

2.5 VALVE TAGS

A. 1-1/2" diameter brass valve tags with 1/4" stamp-engraved designations with piping system abbreviation and sequenced valve numbers. Provide solid brass chain, or solid brass S-hooks of the size and type required for proper attachment of tags to valves.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Install identification after insulation is applied. Protect identification from paint or apply after painting is complete. Install above ceiling identification prior to acoustical ceilings.

B. Attachment: Securely attach all mechanical identification to associated pipe, duct, panels and equipment. Locate identification to be readily visible.

3.2 PIPING SYSTEM IDENTIFICATION

A. Install pipe markers on all piping systems in spaces where piping is exposed, concealed only by removable ceiling system, and where accessible at manholes and access panels.

B. Locate pipe markers near points where piping continues into shafts, underground, floor or wall; at 25' spacing along exposed runs (15' in congested areas), at valves, equipment and control devices, and where there could be question of flow pattern.

C. Install marker over pipe insulation segment on hot non-insulated pipes.

3.3 UNDERGROUND PIPING IDENTIFICATION

A. During back-filling, install continuous underground pipe markers over all buried piping, 6" to 8" below finished grade. Where multiple pipes are in a trench up to 16" wide, install single line marker. For tile fields and similar installations, mark only edge pipe lines of field.

3.4 DUCTWORK IDENTIFICATION

A. Install duct markers on all supply, return, exhaust, intake and relief ductwork where duct is exposed, concealed only by removable ceiling system, and where accessible at access panels.

B. Locate duct markers near points where ductwork originates or continues into shafts, floor or wall, and at 25' spacing along exposed runs.

C. Install duct access door markers on all access doors. Access doors for fire or smoke dampers shall be permanently identified on the exterior by a label having minimum 0.5 inch high lettering reading: FIRE/SMOKE DAMPER, SMOKE DAMPER or FIRE DAMPER.

3.5 EQUIPMENT IDENTIFICATION

A. Provide equipment markers on scheduled equipment.

3.6 VALVE IDENTIFICATION

A. Install valve tags on all new valves, except for check valves, valves within factory-fabricated equipment, plumbing fixture faucets, hose bibs, and valves located directly at the equipment served. Number valves in a logical sequence relative to location installed.

B. List each tagged valve in valve schedule for each piping system. Include a copy of the valve tag schedule in the Operation and Maintenance manuals and mount a laminated copy as directed by the Owner.

C. Where building has previously tagged valves, coordinate numbering with old schedule, and note changes made to previously tagged valves on new schedule.

3.7 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.8 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 20 0553

SECTION 20 0700 - MECHANICAL SYSTEMS INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:

1. Piping insulation materials and installation methods
2. Ductwork insulation materials and installation methods
3. Mechanical equipment insulation materials and installation methods
4. Ductwork acoustical lining materials and installation methods
5. Ductwork fire wrap materials and installation methods

1.3 ASBESTOS ABATEMENT

A. All asbestos within the contract bounds shall be removed per the requirements described in Division 02. Refer to drawings for items containing asbestos insulation. Re-insulate all piping, ductwork and equipment to remain from which asbestos has been removed.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Codes and Standards

1. ASHRAE 90.1-2013

1.5 DELIVERY, STORAGE AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

B. Protect materials against weather and contact with damp or wet surfaces from time of delivery through time of installation. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes.

C. Deliver materials only when environmental conditions meet requirements specified for installation areas. If materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

D. Do not store materials near other materials that may off-gas or emit harmful fumes, such as kerosene heaters, fresh paint, adhesives, etc.

E. When storing prior to installation, raise off floor on pallets, stack flat with protective material between to eliminate chance of creating nicks, scratches, and other imperfections and damage to finish surfaces, wrap weather-tight, and provide for air circulation within and around stacks and under temporary coverings.

F. Do not allow materials to become damp. Maintain temperatures at 60°F or higher, and humidity between 20% and 60% prior to, during and after installation.

1.6 SUBMITTALS

A. Product Data: Submit schedule indicating product used, where it is used, and thickness. For each type of product indicated, include thermal conductivity, water-vapor permeance, thickness, and jackets (both factory and field applied if any).

PART 2 - PRODUCTS

2.1 GENERAL INSULATION REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Insulation thermal conductivity: No greater than value listed, in Btu-inch/hour-square foot-degrees F at 75 degrees F mean temperature.

C. Water Vapor Permeance (ASTM E97 or E96, Procedure A): No greater than value listed, in perms. Water vapor permeability (ASTM C355): No greater than value listed, in perm-inch.

D. Puncture resistance (ASTM D781): No less than value listed

E. Flame spread classification (ASTM E84, NFPA 255): No greater than value listed. Smoke density classification (ASTM E84, NFPA 255): No greater than value listed. Composite listing includes insulation, jacket, and adhesive.

F. Density no less than value listed, in pounds per cubic foot.

2.2 PIPING INSULATION – FIBERGLASS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Johns-Manville; Micro-Lok HP
2. Knauf; Earthwool 1000
3. Owens/Corning; ASJ/SSL-II

B. Fiberglass insulation with factory-applied vapor barrier jacket with self-sealing laps. ASTM C547 Class 1 insulation, conductivity of 0.23 at 75F. Vapor barrier jacket: laminated white kraft paper, aluminum foil, glass fiber reinforcement, water vapor permeance of 0.02 perms, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.

2.3 PIPING INSULATION - CLOSED CELL ELASTOMERIC

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armacell; AP Armaflex
2. Aeroflex; Aerocel
3. K-Flex; INSUL-TUBE

B. Flexible closed cell elastomeric pipe insulation, ASTM C534, conductivity of 0.25, water vapor permeability of 0.20, composite flame spread/ smoke density of 25/50.

2.4 PIPING INSULATION SPECIALTIES

A. PVC Jackets: Provide pre-molded, high impact, 20 mil thickness, UV resistant, 0-150F service temperature.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Zeston
b. Proto

B. Aluminum Jackets: Provide 0.016” thick alloy 3003 aluminum jacketing with longitudinal lock seam and butt strap circumferential joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers
b. Pabco

C. Removable Insulation Jackets: Provide removable insulation jackets with fiberglass insulation, flexible fabric jacket and Velcro fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Thermal Corp
b. Q Master

2.5 DUCTWORK INSULATION – RIGID FIBERGLASS INSULATION BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Johns Manville Type 817 Spin-Glas Insulation Board
2. Knauf Earthwool ASJ Insulation Board
3. Owens/Corning Type 705 ASJ-25 Insulation Board

B. Rigid fiberglass insulation board with factory-applied vapor barrier. Insulation: ASTM C612 Class 2, conductivity of 0.26, density of 3.0 pcf. Vapor barrier: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.02, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.

2.6 DUCTWORK INSULATION – FIBERGLASS BLANKET

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Type 75 FSK Standard Duct Wrap
2. Johns Manville R Series Microlite with FSK
3. Knauf Duct Wrap with Multi-Purpose FSK
4. Owens/Corning All Service Faced Duct Wrap.

B. Fiberglass blanket-type insulation with factory-applied vapor barrier, and 2" stapling and taping flange along one edge. Insulation: ASTM C553, density of 0.75 pcf, conductivity of 0.30. Vapor barrier: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.02, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.

2.7 DUCTWORK INSULATION – CLOSED CELL ELASTOMERIC SHEET

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armacell AP Armaflex Sheet Insulation
2. Aeroflex; Aerocel
3. K-Flex; INSUL-SHEET

B. Closed cell elastomeric insulation sheet. ASTM C534, conductivity of 0.25, water vapor permeability of 0.05 perm-inch, composite flame spread/ smoke density of 25/50.

2.8 DUCTWORK JACKETING – SELF-ADHERING SHEET MEMBRANE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. MFM Building Products Corp FlexClad-400
2. Other approved equivalent

B. Apply self-adhering sheet-type membrane over rigid board insulation for weatherproofing.

C. Submit manufacturer's data sheets, preparation instructions/recommendations, installation methods, and manufacturer's certification letter that materials comply with specified requirements and are suitable for intended application. (Should be under 1.6 Submittals if kept)

D. Membrane General: Prefabricated self-adhering, sheet-type protective membrane. The outer layer is an embossed, UV-resistant aluminum weathering surface. Under the aluminum are multiple layers of high-density cross-linked polymer film. Under the polymer film is a uniform layer of rubberized asphalt adhesive which sticks directly to metal, insulation faces and most other clean, dry surfaces.

E. Release liner: The self-adhesive surface is protected by a disposable release liner.

F. Technical Properties:

1. Material Thickness (ASTM D 1970): 45 Mils (1.0 mm) Nominal
2. Flexibility at -20 degrees F (-29 degrees C) (ASTM D 1970): Pass
3. Vapor Permeance (ASTM E 96): .01 perms
4. Nail Sealability (ASTM D 1970): Pass
5. Heat Aging (ASTM D 794): Pass
6. Elongation (ASTM D 412): 450 percent
7. Tear Resistance (ASTM D 1424): 660 grams
8. Meets 25/50 Flame/Smoke Rating (ASTM E 84)
9. Maximum Temperature: 175 degrees F (79 degrees C)
10. Installation Temperature Range: Greater than 40 degrees F (4.5 degrees C)

2.9 EQUIPMENT INSULATION – CLOSED CELL ELASTOMERIC SHEET

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armacell AP Armaflex Sheet Insulation
2. Aeroflex; Aerocel
3. K-Flex; INSUL-SHEET

B. Closed cell elastomeric insulation sheet. ASTM C534, conductivity of 0.25, water vapor permeability of 0.05 perm-inch, composite flame spread/ smoke density of 25/50.

C. Elastomeric insulation sheet contact adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armacell; Armaflex 520 Adhesive
b. Aeroflex; Aeroseal
c. K-Flex

2.10 SEALING MASTICS FOR PIPE AND DUCT INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Childers
2. Foster
3. Vimasco
4. Mon-Eco Industries

B. Provide mastics to seal insulation joints and to provide a continuous vapor barrier. The permeance of the mastic shall be equal to or less than the permeance of the vapor barrier of the insulation it is applied to. The ASTM E84 flame spread and smoke density classification shall not exceed 25/50. Mastics shall be mercury and asbestos free, selected for the temperature range of the service, and selected for uses recommended by the manufacturer. Mastics used outdoors shall be outdoor rated, waterproof, and U.V. resistant.

2.11 DUCTWORK ACOUSTICAL LINING – CLOSED CELL ELASTOMERIC DUCT LINER

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armacell AP Armaflex SA Black Duct Liner
2. Aeroflex; Aerocel AC
3. K-Flex; DUCT Liner Gray

B. Closed cell elastomeric duct liner. ASTM C177 or C518, conductivity of 0.27. Water vapor permeability of 0.08 per ASTM E 96 Procedure A. Composite flame spread/ smoke density of 25/50.

PART 3 - EXECUTION

3.1 INSULATION GENERAL REQUIREMENTS

A. Insulate piping, ductwork and equipment unless indicated as not to be insulated in subsequent paragraphs.

B. Insulate connection points between new and existing items.

C. Repair or replace insulation damaged during construction.

D. All systems shall be tested and approved before being insulated.

E. The insulation shall be applied over clean, dry surface.

F. Full lengths of insulation shall be used except at end of straight sections and as required to accommodate fittings. Insulation shall be applied with the joints tightly fitted together. Cracks or voids shall be filled with insulation. The edges and seams at all visible locations shall be finished in a neat and workmanlike manner. Manufacturer's recommended installation procedures shall be strictly adhered to.

3.2 PIPING INSULATION THICKNESS TABLE

Minimum insulation thickness in inches, shall comply with the table below for the associated piping system and pipe sizes. Values are based on an R value of 4 per inch thickness. Overall conductance shall comply with ASHRAE 90.1

System Description	Temp Range Deg F	<1”	Thru 1-1/4”	Thru 3”	Thru 6”	8” & above
Hot Water	141-200	1.5	1.5	2.0	2.0	2.0
Hot Water	105-140	1.0	1.0	1.5	1.5	1.5
Cold Water & Coil Condensate	Any	0.5	0.5	0.5	0.5	0.5
Storm (horizontal piping only)	Any	0.5	0.5	0.5	0.5	0.5
Refrigerant Suction	Any	1.0	1.5	1.5	---	---

3.3 PIPING INSULATION APPLICATION

A. Piping-Indoor:

1. Type: Fiberglass
2. Thickness: See Piping Insulation Thickness Table
3. Jacket: Factory ASJ

B. Piping Items not to be Insulated:

1. Unions
2. Flexible connectors, flexible metal hose, flexible neoprene hose
3. Control valves 2” and smaller
4. Safety valves
5. Discharge vent piping
6. Vacuum breakers
7. Sanitary, waste and vent piping
8. Compressed air piping
9. Natural gas piping
10. Refrigerant liquid lines
11. Vertical portion of rain water conductors
12. Below-grade piping, unless otherwise indicated
13. Chrome-plated pipes and fittings, unless potential for personnel injury
14. Air Chambers

C. At fittings and flanges, insulate with wrapped fiberglass insulation of same thickness as adjacent pipe, and cover with pre-molded PVC jackets. Seal edge of jacket with self-sealing vapor barrier tape.

D. For valves, strainers, suction diffusers and other accessories that require maintenance: In hot piping, insulate similar to fittings and flanges. In cold piping, insulate with closed cell elastomeric insulation, installed to be removable for maintenance access.

E. Wherever necessary to seal insulation and provide a complete and continuous vapor barrier, apply two coats of insulating mastic

F. For closed cell elastomeric insulation, seal all butt joints and seams by joining cut edges with adhesive as supplied by the insulation manufacturer

G. Expansion Joints Insulation: Expansion joints shall be insulated with prefabricated insulation blankets, installed in a manner to allow for the repacking of the joints without removing blanket. Hold blankets in place with permanently attached Velcro fasteners

H. Removable Insulation Jackets: Where indicated on drawings, provide removable insulation jackets.

3.4 DUCTWORK INSULATION APPLICATION

A. Ductwork – Indoor Exposed: In mechanical equipment rooms and all other areas where visible without removing ceilings or opening access panels.

1. Type: Rigid Fiberglass Insulation Board
2. Thickness: 1-1/2”
3. Jacket: Factory ASJ

B. Ductwork – Indoor Concealed: In ceiling spaces, building shafts, and other locations where not visible

1. Type: Fiberglass Blanket
2. Thickness: 1-1/2”
3. Jacket: Factory FSK

C. Ductwork Items Not To Be Insulated:

1. Indoor return air ductwork in conditioned areas
2. Exhaust air ductwork (insulate indoor duct between damper and exterior of building)
3. Exhaust air plenums (insulate indoor plenum between damper and building exterior)
4. Economizer relief air ductwork (insulate indoor duct between damper and building exterior)
5. The following spaces are normally considered conditioned areas: return air plenums above ceilings, heated penthouse, mechanical and electrical rooms

D. All exposed ductwork insulation shall be applied with edges butted. Insulation shall be impaled over stick clips or pins welded to the duct and secured with speed clips. Spacing of pins shall be as required to hold insulation firmly in place but not less than one pin per square foot. All joints and penetrations of the vapor barrier shall be sealed with a 3" wide strip of the same material, supplied with vapor barrier adhesive to both surfaces as recommended by adhesive manufacturers.

E. Blanket insulation shall be tightly sealed at all joints and seams. Insulation shall be cut longer than ductwork perimeter to allow maximum thickness on all areas and to avoid excessive compression. All joints shall be over-lapped at least 2" and stapled in place. The stapled seams shall be sealed with a minimum 3" wide pressure sensitive tape designed for use with the duct insulation. All breaks in the vapor barrier facing shall be sealed with the tape. The underside of ductwork 18" or greater in width, and vertical surfaces 48" or greater shall have the insulation additionally secured with mechanical fasteners and speed clips spaced approximately 12" on center. The protruding ends of the fasteners shall be cut off flush after the speed clips are installed, and then sealed with the same tape as specified above.

3.5 HOT EQUIPMENT INSULATION APPLICATION

A. Hot Equipment Insulation

1. Type: Rigid Fiberglass Insulation Board
2. Thickness: See Below
3. Jacket: None for indoor equipment, PVC for outdoor equipment

B. Insulate all equipment with surface temperature over 100F.

C. Apply insulation in thickness as follows:

1. 1-1/2" for operating temperature up to 150F
2. 2" for operating temperature of 150F to 200F
3. 3" for operating temperature over 200F

D. Cut, score, or miter insulation to fit contour of equipment and secure with galvanized steel bands or wire, or weld pins. Stagger joints where possible and fill voids with insulating cement. Apply 1" galvanized wire mesh over entire exterior surface and finish with two coats of insulating cement troweled to a hard finish.

E. Hot Equipment Not To Be Insulated:

1. Hot water pumps
2. Steam condensate pumps
3. Boiler feedwater pumps
4. Heating hot water system chemical shot feeders
5. Domestic water or heating hot water expansion tanks

3.6 COLD EQUIPMENT INSULATION APPLICATION

A. Cold Equipment Insulation

1. Type: Closed Cell Elastomeric Sheet
2. Thickness: 1”
3. Jacket: None for indoor equipment, PVC for outdoor equipment

B. Insulate all equipment with surface temperature below 60F.

C. Apply elastomeric insulation sheet with contact adhesive

D. Cold Equipment Not To Be Insulated:

1. Water softener shells
2. Vacuum pumps
3. Factory insulated equipment
4. Vibration-control devices

3.7 DUCTWORK ACOUSTICAL LINING APPLICATION

A. Ductwork Acoustical Lining

1. Type: Closed Cell Elastomeric Duct Liner
2. Thickness: 1”
3. Jacket: None

B. For the first 10 feet of supply air ductwork connected to equipment, acoustically line the duct with 1” closed cell elastomeric duct liner if indicated on the Drawings.

C. For the first 10 feet of return air ductwork connected to equipment (and for the return air boot for heat pumps that have no return air ductwork), acoustically line the duct or return air boot with 1” of closed cell elastomeric duct liner if indicated on the Drawings.

D. Other locations indicated on the Drawings.

END OF SECTION 20 0700

SECTION 20 1100 - PLUMBING AND HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies pipe materials, fittings, joining methods, piping specialties and installation methods. In addition, pressure testing and flushing/cleaning procedures are outlined.

1. Plumbing piping systems
2. Hydronic piping systems
3. Pipe joints
4. Mechanically formed tee connections in copper piping
5. Unions
6. Pipe sleeves
7. Dielectric fittings
8. Pipe anchors
9. Piping transitions
10. Pipe sleeve seal systems

1.3 SUBMITTALS

A. Product Data: Include manufacturer, catalog illustrations, model, rated capacities, performance, dimensions, component sizes, rough-in requirements, materials of construction, and operating and maintenance clearance requirements. Additionally include:

1. Provide a piping material schedule that indicates, by service, pipe material, pipe manufacturer, fitting type and manufacturer, joint type and manufacturer.
2. Solder and brazing material data sheets.
3. Grooved fittings, couplings, and accessories data sheets.
4. Data sheets for all products listed in this section including fittings, flanges and gaskets.
5. For underground pressurized and steam condensate piping systems, provide a simplified drawing of the piping system identifying pipe depth and slope, location and type of each joint and restraint, valve, and similar accessories, and dimensions of any expansion loops

1.4 QUALITY ASSURANCE

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the specified quality assurance standards; latest editions, unless noted otherwise.

1. All piping, (including vacuum piping), unless noted otherwise, shall comply with ANSI Standard B31.9 - Building Service Piping.
2. All steam piping above 15 psig, and all steam condensate piping shall comply with ANSI Standard B31.1 - Power Piping.
3. National Sanitation Foundation NSF/ANSI-61, including Annex G (listed as ≤ 0.25% weighted average lead content)(and/or NSF/ANSI-372)and Annex F. Applies to any item in contact with domestic (potable) water.
4. U.S. Safe Drinking Water Act (any item in contact with domestic (potable) water)
5. AWWA C600 Standard for Installation of Ductile-Iron Water Mains and their Appurtenances.

6. AWWA C606 Grooved and Shouldered Joints.
7. Mill certifications indicating country of origin and compliance to ASTM/ANSI/NSF and other required compliance standards verified by independent third party based in the United States shall be promptly provided whenever requested.
8. NFPA 54 - National Fuel Gas Code

C. Regulatory Requirements For Refrigerant Piping Systems: Comply with provisions of the following codes:

1. ANSI B31.5: ASME Code for Pressure Piping - Refrigerant Piping.
2. ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration.
3. ASHRAE Standard 34: Number Designation and Safety Classification of Refrigerants.
4. EPA requirements in Section 608: Prohibition of Venting and Regulation of CFC Requirements.
5. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves".

D. Regulatory Requirements For Natural Gas Piping Systems: Comply with provisions of the following codes:

1. Comply with the requirements of NFPA 54 - National Fuel Gas Code, for gas piping materials and components, and gas piping systems installation, inspection, testing, and purging.

E. Regulatory Requirements For Steam and Condensate Piping Systems: Comply with provisions of the following codes:

1. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
2. ASME Compliance: Comply with ASME B31.1, "Power Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store piping materials and accessories off the floor/ground on pallets and protected with coverings to prevent damage or contamination due to weather and construction activities. Provide temporary protective caps on pipe ends. Maintain caps installed at all times until just prior to assembly, and recap open pipe ends at the conclusion of each work day. Store in areas that prevent damage due to freezing and extreme temperatures or sunlight. Arrange coverings to provide air circulation to avoid damage from condensation or chemical build-up. Protect from damage, dirt and debris at all times.

1.6 WARRANTY

A. Provide a complete warranty for parts and labor for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL PIPING REQUIREMENTS

A. See Part 3 for application of piping type and material.

B. All piping materials shall be compatible for temperature, pressure and service.

C. Provide long radius elbows and returns on welded steel pipe.

2.2 PIPE JOINTS

A. Soldered Joints: ASTM B32; Alloy Sb5, (95% Tin, 5% Antimony, maximum 0.20% Lead). When recommended by the component manufacturer, use manufacturer's recommended flux. Unless noted otherwise, joints may be screwed or flanged to suit valves and equipment. Manufacturers: Engelehard "Silverbrite 100", Harris "Bridgit"

B. Brazed Joints: ASTM B32, silver brazed joints with 1000F minimum melting point, conforming to AWS - A5.8, "Specification for brazing filler metal". Classification BAg-1. For domestic potable water applications, maintain a nitrogen purge during brazing to prevent deposit formation inside the pipe. Unless noted otherwise, joints may be screwed or flanged to suit valves and equipment. Manufacturers: Lucas-Milhaupt Inc. "Sil-Fos", J.W. Harris "Stay-Silv 15" and "Safety Silv"

C. Screwed Joints: Tapered thread, ASME B1.20.1, joined with compatible compound or sealant tape applied to male thread only.

D. Welded Joints: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded. Pipe and fittings shall be beveled and butt welded.

E. Press Joints:

1. Limited to a maximum pipe size of 4".
2. Rated for a minimum 200 PSI working pressure from -4ºF to 250ºF.
3. Compatible with seamless type K, L, and M copper tube conforming to ASTM B88.
4. Fittings shall be a minimum 78% copper and a maximum of 15% zinc, alloyed to prevent dezincification.
5. Fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.12.
6. Seals/O-rings shall be peroxide cured EPDM.
7. Joints shall be pressed using the tool approved by the manufacturer.
8. Provide press fittings from the same manufacturer for the entire scope of the work, for each system.
9. For piping 2" and smaller, non-fitting components such as valves, strainers, check valves, etc. manufactured by the press fitting manufacturer may be used provided:

    a. the press fitting manufacturer is approved for those components elsewhere in the specifications
    b. such components fully comply to the requirements of the respective specification section for the component.

10. Approved fitting, tool, and process:

    a. Viega ProPress
    b. NIBCO Press System.
    c. Apollo Xpress

G. Flanged Joints:

1. Select flange and gasket materials to suit service of piping and to comply with the respective ASME B31.1 or B31.9 piping standard.
2. For steel pipe, provide raised face ANSI B16.5 compliant steel flanges.

3. For copper pipe, provide Class 150 flat face ANSI B16.24 cast bronze flanges, brazed to the copper tube.

    a. Alternative: Copper companion flange by CTS Fabrication USA rated 450 PSI minimum working pressure from -66ºF to 272ºF. ANSI B16.5 compliant, powder coated, with an EPDM insulator adhered to the plate steel flange protruding inside of the flange to prevent contact with the copper companion flange adapter. Flange adapter shall be manufactured to ASME B16.22, brazed to the copper tube.

4. Gaskets shall conform to respective ANSI Standards, A21.11, B16.20, B16.21. Gaskets in steam and condensate lines shall be “FLEXTALLIC”, 316 L stainless steel with “FLEXICARB” filler. Flange gaskets for domestic hot water shall be 100% PTFE. For butterfly valves on replaceable seat side with interfering set-screws, provide Garlock Style 9800.
5. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated. Central Power Plant and Tunnels: Provide ASTM A193 B7 bolts and studs with ASTM A194 grade 2H heavy hex nuts.

H. Hubless Joints for Cast Iron No-Hub Pipe: Heavy duty ASTM C1540 couplings with stainless steel shield with stainless steel bands and tightening devices, ASTM C564 rubber sleeve with integral center pipe stop.

1. When connecting cast iron no-hub pipe to dis-similar pipe: Provide ASTM C1460 couplings specifically designed for both pipe types, with stainless steel shield with stainless steel bands and tightening devices, with ASTM C564 rubber sleeve with integral center pipe stop. Unshielded couplings shall not be used. Connections between dis-similar pipe materials shall be restrained. Submit coupling and restraint methods for approval
2. Approved Manufacturers:

    a. Anaco/Huskey
    b. Clamp-All Corp.
    c. Fernco Inc.
    d. Ideal Tridon
    e. Mission Rubber Company (MCP Industries Inc.)

I. Gasket Joint Lubricant - for use with grooved and hubless joints: Provide manufacturer’s recommended gasket lubricant.

J. Solvent Cement Joints: Select materials suitable for pipe materials joined and compatible with fluid served. Conform to respective ASTM Standards D-2235, D-2564, D-2855 and D-3138.

2.3 MECHANICALLY FORMED TEE CONNECTIONS IN COPPER PIPING

A. Contractor may use mechanically formed Tee connections in copper piping in lieu of tee fitting only where main piping is 2 1/2" or larger and where branch connection is 3/4" or smaller. Joint must be brazed. Tool manufacturer: T-Drill.

2.4 UNIONS

A. Unions in steel piping systems shall be malleable iron with ground joints made between two bronze inserts.

B. Unions in copper piping systems shall be wrought copper or brass with sweat ends.

2.5 PIPE SLEEVES

A. Provide pipe sleeves where required, including the following locations:

1. Where required by code
2. Where required as part of rated penetration, to maintain fire and smoke rating

3. To support vertical piping (to support riser clamps)
4. Where required to maintain water seal and prevent water penetration
5. Where pipe movement is anticipated (especially due to thermal expansion) at the penetration

B. Fire protection piping, compressed air piping and other un-insulated piping: Sleeves are generally not required, unless required to maintain integrity of rated walls or floors.

C. Cold water: Sleeves are required for all piping 2” and larger penetrating walls and floors.

D. Heating hot water and other hot insulated piping: Sleeves are required for all piping penetrating walls and floors

E. For underground exterior wall penetrations, piping penetrations must be watertight. For new construction, provide cast-in-place sleeve with integral water-stop, oversized for the use of a pipe sleeve seal.

2.6 DIELECTRIC FITTINGS

A. For pipe 2 inch and less: Provide brass coupling. (Dielectric unions are not acceptable).

B. For pipe 2-1/2 inch and larger: Provide flange union with dielectric gasket and bolt sleeves. On copper pipe, copper companion flanges by CTS Fabrication USA shall be used.

C. Dielectric waterways are prohibited for all joint systems.

2.7 PIPE ANCHORS

A. Provide pipe anchors where shown and as detailed on drawings.

2.8 PIPING TRANSITIONS

A. For dissimilar metal connections, see “Dielectric Fittings”.

B. When two different pipe materials must be joined such as cast iron, clay, steel, copper or plastic, provide transition fittings specifically designed for that purpose and that are manufactured in compliance with the standards relevant for the pipes joined. Transitions shall have equal corrosion resistance to the pipes joined.

2.9 PIPE SLEEVE SEAL SYSTEMS

A. Approved Manufacturers:

1. EnPro Industries “Link Seal”
2. Advance Products & Systems, Inc.
3. Metraflex Company.
4. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve. Shall provide a water-proof seal between the pipe and sleeve at up to 20 psig head pressure. Each link and pressure plate shall include permanent identification of size and manufacturer's name. Manufactured in an approved ISO-9001:2000 facility.

C. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe.

D. Pressure Plates: Molded of glass reinforced nylon.

E. Connecting Bolts and Nuts: Mild steel with a 60,000 psi minimum tensile strength and 2-part Zinc Dichromate coating per ASTM B-633 and Organic Coating, tested in accordance with ASTM B-117 to pass a 1,500-hour salt spray test. Of length required to secure pressure plates to sealing elements.

F. Sleeves:

1. Galvanized steel, ASTM A53/A53M, Schedule 40, with plain ends and welded steel collar, zinc coated. Steel Sleeve sizes 12” and larger shall be 0.375” thick or standard pipe wall thickness. Sleeves through wall shall be cast in place and the pipe shall be installed centered in the sleeve. Provide 2” collar (water-stop) of steel to match sleeve, welded all around on both sides to the sleeve at the point on the sleeve that positions it at the mid-point of the structural wall when the sleeve is in place.
2. Molded non-metallic high density polyethylene sleeves (HDPE) with integral hollow, molded water-stop ring four inches larger than the outside diameter of the sleeve itself. End caps and reinforcing ribs, manufactured in an approved ISO-9001:2000 facility.

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATION REQUIREMENTS

A. Work shall be done in accordance with applicable ordinances and codes. Arrange for inspections.

B. For domestic potable water applications, maintain a nitrogen purge during brazing to prevent deposit formation inside the pipe, so that the inner pipe surface remains clean. Properly ventilate the area outside the pipe to avoid unsafe levels of nitrogen.

C. Install pipe components and joining systems in accordance with the manufacturer's installation instructions.

D. Install piping to permit complete draining. Provide capped hose end ball type drain valves at all low points.

E. If water (flushing water, blow down, etc.) or hydronic system fluids have a pH between 5.0 and 10.0 and meet the requirements of the local municipality Sewer Use Ordinance, it may be discharged to the sanitary sewer. If the water does not meet the sewer discharge limits, then provide for alternate disposal means approved by local and state jurisdictions.

F. Installed piping shall be free from sagging. Provide for expansion and contraction of piping in an approved and safe manner by means of loops or offsets, where mechanical expansion joints are not specifically called for.

G. Branch connections from horizontal steam, steam condensate, and gaseous system mains shall be taken off the top, up at a 45 degree angle, or off the side.

H. Branch connections from horizontal hydronic system mains shall not be taken off the main bottom, or at less than 45 degrees from horizontal.

I. Branch piping shall be valved at the branch connection points.

J. Provide fittings and specialties necessary to properly interconnect all items, whether or not shown in detail.

K. Piping shall remain protected and capped until just prior to connection. Immediately after assembly, restore all protection and cap unprotected ends to prevent odors, dust, moisture, and other debris from entering the piping system.

L. Clean and swab-out all piping before installation.

M. Lay out pipe lines straight, plumb and in true alignment. Offset as required to avoid interference with other work, to conceal piping, to allow maximum headroom and to avoid interference with windows and doors. Lay out all pipes and establish their levels from bench marks, existing floors or finished grades.

N. Piping shall be concealed unless indicated otherwise on drawings. Do not conceal piping until it has been inspected, tested, flushed and approved.

O. Use eccentric reducing fittings to increase or decrease pipe sizes. Bushings are not acceptable. Orient reducers to prevent trapping of water.

P. Lubricate flange bolts and install with hardened flat washers. Use a torque wrench to tighten flange bolts to the gasket manufacturer's recommended torque.

Q. Locate groups of pipe parallel to each other, spaced to permit applying insulation and servicing of valves. Install hot and cold water lines at least 6 inches apart.

R. Install piping at least 3 inches clear of electrical conduit. Do not install pipe within the National Electrical Code (NEC) working space zone of electrical equipment. Examples:

1. Above the footprint of electrical equipment in the zone extending 6' above the installed height of the equipment.
2. Within the NEC working space in front of the electrical equipment. NEC working space varies depending on voltage and other factors. Typically for equipment 600 volts or less it extends from the floor to the height of the equipment or 6'-6", whichever greater, 3'-6" in front of the equipment, and for the width of the equipment or 30", whichever is greater.
3. Verify NEC clearance requirements prior to installing work. Note that variable frequency drives are considered electrical equipment.

S. Pipe extending into finished areas shall have chrome plated escutcheons large enough to cover pipe sleeves and shall fit snugly over pipe or insulation.

T. Pitch piping as follows, but not less than required by code:

1. Hydronic piping up in direction of flow at 1/16" per foot
2. Steam piping down in direction of flow at 1/16" per foot
3. Vent piping back toward waste at 1/16" per foot
4. Waste, condensate and compressed air piping down in direction of flow at 1/8" per foot.

U. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

1. Support vertical pipe at no less than every floor level, at the base of each riser, and at every riser offset.
2. Support horizontal pipe 5" diameter and greater with a minimum of two pipe hangers between couplings, except sections of pipe less than 4 feet in developed length are permitted to be supported with no less than one hanger between couplings.
3. All horizontal piping 5" diameter and greater shall be restrained or braced to prevent movement at each joint at every direction change and at each branch connection.
4. Provide pipe hangers to support every horizontal branch connection; provide sway bracing when pipe is suspended in excess of 18" by non-rigid hangers, and comply with all other bracing, support, and installation recommendations and suggestions in the CISPI Handbook.
5. Provide hangers and supports to eliminate all misalignment at couplings.
6. Tighten all clamps to coupling manufacturer's recommended torque, using a torque wrench.
7. Joints between dissimilar pipe materials shall be restrained

V. Sanitary and storm piping shall be anchored upstream of the first coupling at the point of building exit (interior side) to prevent movement due to back surges, by permanent blocks, bracing, threaded rodding anchored to the exterior wall, or other suitable means.

W. Pipe Sleeves: Furnish and set pipe sleeves per details on drawings

X. Pipe Anchors: Furnish and install pipe anchors where shown and as detailed on drawings

3.2 PLUMBING PIPING SYSTEMS APPLICATION

A. Domestic Cold Water, Hot Water and Hot Water Return - Above Ground (including non-potable)

1. For piping through 6”:

a. Pipe: Type L Copper, hard drawn, ASTM B88
b. Fittings: Wrought Copper, ANSI B16.22
c. Joints:

1) Soldered: through 2”
2) Brazed: for 2-1/2” through 6”
3) Press-to-Connect: for cold water, hot water and hot water return piping through 4", may be used excluding inaccessible locations.

B. Sanitary Waste and Vent - Above Ground

1. For piping through 12”:

a. Pipe: Cast Iron, Service Weight, CISPI Standard 301, ASTM A74, ASTM A888
b. Fittings: Cast Iron, drainage pattern, ASTM A74, ASTM C564
c. Joints: Hubless - Heavy duty, ASTM C1540 shielded couplings

C. Sanitary Waste and Vent - Under Ground

1. For piping through 12”:

a. Pipe: Cast Iron, Service Weight, CISPI Standard 301, ASTM A74, ASTM A888
b. Fittings: Cast Iron, drainage pattern, ASTM A74, ASTM C564
c. Joints: Hubless - Heavy duty, ASTM C1540 shielded couplings

2. For piping through 12”:

a. Pipe: PVC Schedule 40, ASTM D 2665, NSF approved, type DWV
b. Fittings: PVC, ASTM D 3311
c. Joints: Solvent weld, ASTM D2564

3.3 UNDERGROUND PIPING INSTALLATION REQUIREMENTS

A. Piping below grade intersecting tunnel walls, basement walls, or penetrating floors, shall be run through a sleeve seal system.

1. Size sleeves and select sleeve seal links per sleeve seal manufacturer’s recommendations.
2. Install sleeves and seals per manufacture’s recommendations. Center sleeve water stops at midpoint of wall/floor thickness. Provide temporary support to avoid sleeve collapse during pours.

B. Record as-built sketches and dimensions prior to backfilling.

3.4 WELDING

A. All welding shall be performed by registered welders qualified to perform welding operations in accordance with the National Certified Pipe Welding Bureau’s procedures and standards, ASME Code Standards and the HPACCNA Standard Manual of Welding.

B. Submit a certified copy of “Record of Pipefitter Welder Performance Qualification Test” of any employees who will be doing welding on this project.

C. No welding to building work shall be allowed without approval of Engineer.

D. Except where prohibited by the Reference Standards, code, or ordinance, Black steel piping larger than 6 inch diameter may be welded with chill rings.

E. Mitered turns will not be allowed. Turns shall be made with factory-made ASME B16.9 long radius wrought steel buttwelding fittings.

F. Except where prohibited by the Reference Standards, code, or ordinance, branch take-offs with manufactured formed nipples will be permitted provided nipple size is at least two pipe sizes smaller than the main size. Formed nipples shall be Bonney Forge “Weldolets”, “Threadolets”, “Sockolets”. In all other cases, use factory-made ASME B16.9 wrought steel buttwelding tee fittings.

G. Shop welded pipe assemblies shall have all welds plainly stamped by the welding operator for inspection by the Engineer before installation.

3.5 PROTECTION AGAINST FREEZING

A. At any time that any of the piping is full of water for testing purposes or otherwise prior to actual heated operation, the system shall be protected against freezing by the introduction of pre-mixed propylene glycol type anti-freeze which will be flushed out before acceptance. Provision for introducing anti-freeze shall be made by means of valved connections to the system in an acceptable manner.

3.6 INSTALLATION OF PIPE HANGERS AND SUPPORTS

A. Arrange pipe hangers and supports to permit proper pitch of piping, free to move with pipe expansion, installed at proper intervals to prevent sagging and attached to building construction through approved means. Hangers shall be located near or at changes in piping direction and concentrated loads. Valves, strainers, in line pumps and other heavy equipment shall be supported independent of the pipes. After systems have been installed and filled, adjust hangers and supports to evenly distribute weight, and maintain proper pitch.

B. Vertical Piping: When support locations are not indicated on the drawings, support piping at every floor level.

C. Horizontal Piping Hanger Spacing: Space hangers in compliance with applicable codes, or per MSS SP-89, which ever results in shortest spacing.

D. For cold piping, install hangers and supports to maintain an effective continuous thermal and vapor barrier between cold piping and hangers and supports.

E. Plastic Piping: Hang and support in compliance with manufacturer’s recommendations. At hangers and supports, including channel supports, install to prevent plastic pipe contact with metal (exception: angle iron may be used for continuous support, provided all sharp edges are removed). Anchor piping only where required for expansion loops or to protect against pressure surges, etc. Compression style clamps/supports shall not be used. Use plastic pipe sleeves or equivalent as guides at all other locations, to allow longitudinal thermal expansion and to prevent lateral pipe movement. Compression style riser clamps shall not be used, use other support methods such a supporting at fitting shoulders. Support valves and other significant weight components independent of pipe. Space hangers no farther than manufacturer’s recommendations for the application temperature but in no case farther than recommended for 100 deg. F application temperature. Continuously support all piping 1.5-inch nominal diameter or less (exception: PVC pipe connected to sump pumps). Provide thrust restraints where piping is subject to cyclic pressure surges, e.g. on/off pump applications.

3.7 INSTALLATION OF PIPE SLEEVES

A. Install pipe sleeves where piping passes through building construction including all walls, floors and ceilings.

B. For new wall construction, promptly and accurately locate and securely set sleeves in forms before concrete is poured. For masonry construction, set the sleeves over the piping for Masonry Contractor to build around.

3.8 TRENCHING AND BACKFILLING

A. All trenching and backfilling required for the proper installation of the work shall be done as prescribed in other Divisions.

B. Excavate trenches so that pipe can be installed at proper depth. Lay pipe on a firm bed bearing its full length except at the bell. Where sewers are installed in backfilled areas, provide machine tamping and be responsible for any settling at, or rupture to the sewer work. Keep trenches water free and as dry as possible during bedding, laying and jointing. After the joints are made, place sufficient backfill along each side of pipe to offset conditions that might tend to move the pipe off line and grade.

C. Backfill only after pipes have been tested, inspected and approved.

D. Piping encountered in excavating, (if shown on the drawings or not), shall be supported, and protected from damage. If utility lines are encountered, notify the Owner's Representative and do not disturb the lines unless so directed. If existing utility lines are damaged during excavations, immediately repair the lines at no cost to the Owner.

E. Storm and sanitary piping may be installed side by side in same trench. Water piping may be installed in same trench with drainage piping, provided trench is benched so the water pipe may be laid on a shelf of firm earth not less than eighteen inches (18") above top of drain pipe.

F. No excavation for pipe shall be made in filled or disturbed earth until it has been compacted as directed.

G. Restore street pavements, curbs and sidewalks disturbed in the performance of this work. Restore in a manner prescribed by authorities having jurisdiction.

H. Where mains are to pass under roadways or in any locations where open ditches are dangerous or undesirable, the work is to be installed by tunneling. In all other locations, excavations shall be done by the open trench method and to the depths and widths as may be necessary. All material excavated shall be deposited on the sides of the trenches and beyond the reach of slides.

I. Supports:

1. Where lines pass under footings for walls or columns, or lower than adjacent footings, backfill trenches with concrete up to the level of the bottom of the footings.
2. Where pipes pass over column footings, or are laid in filled ground, or above the original natural grade, or in soil of insufficient bearing quality, or in other cases where necessary, they shall be supported by creosoted timbers carried by brick piers or piles or other approved supports carried down to firm bearing as approved.

J. Provide shoring, bracing or sheet piling necessary to maintain the banks of the excavations, or tunnels. Take same out as the work is backfilled. Shoring must prevent any movement of the trench banks and strains on the piping and utility lines.

3.9 FLUSHING AND CLEANING OF PIPING

A. Flush the following piping systems:

1. Domestic Cold Water
2. Domestic Hot Water

B. Clean the following piping systems:

1. Heating Hot Water Supply and Return

C. Develop plan for flushing and cleaning piping. Submit plan for approval prior to completion of piping. Provide all temporary and permanent piping, equipment, materials necessary to complete flushing and cleaning.

D. Prior to flushing, swab out underground piping to remove all particulate.

E. Prior to flushing, temporarily remove, isolate or bypass dirt sensitive equipment and devices, including the following:

1. Automatic flow control valves
2. Heating and cooling coils
3. Boilers
4. Flow measuring devices

Reinstall after flushing is complete.

F. Prior to flushing, install fine mesh construction strainers at inlet to all equipment. Install fine mesh construction element in permanent strainers. During flushing and cleaning, remove and clean strainers periodically. At completion of final flush, clean permanent strainers, remove construction strainers.

G. Flushing for new piping: Flush all piping with cold water (or fire protection system where approved by owner) for a minimum of one hour, until water runs clear. Water supply shall be equivalent to piping to be flushed. Use (2) 2-1/2” fire hose connections for piping 3” and larger. Drain all low points.

H. Chemical Cleaning for new and existing hydronic piping: Where flushing could not be completed at 6 feet per second, or where chemical cleaning is required for new and existing piping, circulate flush water and clean strainers prior to installing cleaning chemicals. Provide cleaning chemicals, under the direction of the owner’s chemical supplier. Following flushing, install cleaning chemicals and circulate through the entire system for a minimum of one hour, or as directed by chemical supplier. Take water sample for owner’s use. Drain system, including all low points. Flush, drain and fill system, circulate for one hour, sample for owner’s use. Drain, flush, fill, circulate and sample until system is free of cleaning chemicals, as indicated by owner’s analysis of samples.

1. Estimated system volume for Hot Water Heating System:

3.10 PIPING SYSTEM PRESSURE TESTING

A. General:

1. Test new systems only, from point of connection to the existing systems. Perform initial tests and correct deficiencies prior to requesting acceptance test.
2. Perform acceptance pressure tests in the presence of the authorities having jurisdiction. Acceptance tests must be satisfactorily completed before piping surfaces are concealed.

3. Pneumatic tests shall be conducted using dry, oil free compressed air, carbon dioxide or nitrogen. Evacuate personnel not directly involved in testing prior to performing pneumatic testing. Perform testing in two stages, initial and acceptance. Conduct initial testing at 5 PSI or less. Swab joints with a commercial leak detector. Repair deficiencies prior to testing at higher pressures. Under no circumstances shall plastic piping of any type be pneumatically tested, including pre-acceptance tests.
4. Components shall be removed or isolated during testing if damage may occur due to test pressure and/or test media.
5. Existing steam and hot water piping connected to piping to be tested shall be shutoff, drained and cooled before testing.

B. Acceptance Pressure Testing:

1. Perform acceptance testing at 1.5 times the maximum system design pressure but not less than 100 psig or to the satisfaction of the authority having jurisdiction.
2. Remake leaking gasket joints with new flange bolting. Where welded joints fail, submit proposed method of repair for approval by the Owner's representative and authorities having jurisdiction.
3. For each system tested, provide a certificate testifying that the system was satisfactorily tested and passed, using owner furnished forms.

3.11 FLUSHING, DISINFECTING, AND TESTING DOMESTIC WATER PIPING

A. Flush, disinfect and test domestic water piping as follows:

1. Prior to disinfection, flush all domestic water piping as described under Flushing and Cleaning of Piping.
2. Purge and disinfect domestic water piping per plumbing code and local municipality requirements. Do not use excessive amounts of disinfectant, as it may damage piping seals.
3. Submit water samples in sterile bottles to the local municipality. Repeat the procedure if the biological examination made by the local municipality shows evidence of contamination.

B. Prepare reports for all purging and disinfecting activities. Furnish owner final copy of test results for acceptance.

END OF SECTION 20 1100

SECTION 22 1119 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig.
2. Sanitary Waste and Vent Piping: 10 foot head of water.
3. Storm Drainage Piping: 10 foot head of water.
4. Force-Main Piping: 100 psig.

1.3 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

1. Backflow preventers and water regulators
2. Balancing valves, water filters, and strainers
3. Thermostatic water mixing valves
4. Garbage disposal
5. Water hammer arresters, air vents, and trap seal primer valves and systems
6. Drain valves, hose bibbs, hydrants, and hose stations
7. Outlet boxes and washer-supply outlets
8. Cleanouts, floor drains, open receptors, trench drains, and roof drains
9. Air-admittance valves, vent caps, vent terminals, and roof flashing assemblies
10. Sleeve penetration systems

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Backflow preventers and water regulators
2. Water filters
3. Thermostatic water mixing valves and water tempering valves
4. Trap seal primer valves and systems
5. Hose stations and hydrants
6. Grease interceptors, grease recovery units, oil interceptors, and solids interceptors

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 01 Sections.

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

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. Water Filter Cartridges: Equal to 200 percent of amount installed for each type and size indicated.
2. Operating Key Handles: Equal to 100 percent of amount installed for each key-operated hose bibb and hydrant installed.

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 Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 BACKFLOW PREVENTERS

A. Manufacturers:

1. Conbraco Industries, Inc.
2. Mueller Company; Hersey Meters Division
3. Watts Industries, Inc.; Water Products Division
4. Zurn Industries, Inc.; Wilkins Division
5. Febco

B. General: ASSE standard, backflow preventers.

1. NPS 2 and Smaller: Bronze body with threaded ends.
2. Interior Components: Corrosion-resistant materials.
3. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
4. Strainer: On inlet, if indicated.

C. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

D. Hose-Connection Vacuum Breakers: ASSE 1011, nickel-plated, with non-removable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

E. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and two independent check valves with intermediate atmospheric vent.

F. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

G. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

H. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

I. Dual-Check-Valve-Type Backflow Preventers: ASSE 1024, suitable for continuous pressure application. Include union inlet and two independent check valves.

J. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3 gpm flow and applications with up to 10 foot head of water back pressure. Include two check valves; intermediate atmospheric vent; and non-removable, ASME B1.20.7, garden-hose threads on outlet.

K. Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

2.3 BALANCING VALVES

A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.

1. Manufacturers:

a. ITT Industries; Bell & Gossett Division
b. Taco, Inc.
c. Tour & Andersson, Inc.
d. Flow Design, Inc.

2. NPS 2 and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
3. NPS 2 and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
4. NPS 2-1/2 and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.

2.4 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

1. Manufacturers:

a. MIFAB Manufacturing, Inc.
b. Josam Company
c. Watts Industries, Inc.; Drainage Products Division
d. Watts Industries, Inc.; Water Products Division
e. Zurn Industries, Inc.; Wilkins Division

B. Open Drains: 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.

C. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

D. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semi-open top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

E. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

F. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.

G. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

H. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

2.5 SLEEVE PENETRATION SYSTEMS

A. Manufacturers:

1. ProSet Systems, Inc.
2. Other approved

B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
2. Stack Fitting: ASTM A 48, gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.6 CLEANOUTS

A. Cleanouts: Comply with [ASME A112.36.2M] [ASME A112.3.1] <Insert other>.

1. Application: Floor cleanout and wall cleanout.
2. Products:

    a. MIFAB Manufacturing, Inc., model C1220
    b. Josam Company
    c. Smith, Jay R. Manufacturing Company
    d. Tyler Pipe, Wade Division
    e. Watts Industries, Inc., Drainage Products Division
    f. Zurn Industries, Inc., Specification Drainage Operation, model Z1400

3. Body or Ferrule Material: Cast iron.
4. Clamping Device: Required.
5. Outlet Connection: Threaded.
6. Closure: Brass plug with straight threads and gasket.
7. Adjustable Housing Material: Set-screws or other device.
8. Frame and Cover Material and Finish: Stainless steel Z1469.
9. Frame and Cover Shape: Round.
10. Top Loading Classification: Heavy duty.

2.7 FLOOR DRAINS (REFER TO DRAWING FOR OUTLET SIZE(S))

A. Floor Drains: Comply with ASME A112.21.1M.

1. Application: Type FD-1.
2. Products:

    a. Smith, Jay R. Manufacturing Company
    b. Zurn Industries, Inc., model Z-415S-NH
    c. Tyler Pipe, Wade Division
    d. Josam Company
    e. MIFAB Manufacturing, Inc.

3. Body Material: Gray iron.
4. Seepage Flange: Required.
5. Clamping Device: Required.
6. Outlet: Bottom.
7. Exposed Surfaces and Interior Lining: Not required.
8. Sediment Bucket: Required.
9. Top or Strainer Material: Polished nickel bronze.
10. Top of Body and Strainer Finish: Polished nickel bronze.
11. Top Shape: Square.
12. Dimensions of Top or Strainer: 6 x 6 inch.
13. Top Loading Classification: Medium Duty.
14. Funnel: Not required.
15. Inlet Fitting: Not required.
16. Trap Material: Cast iron.
17. Trap Pattern: Deep-seal P-trap.
18. Trap Features: 1/2" trap seal primer valve drain connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Section 22 0510 "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install garbage disposal per manufacturer’s recommendations. Coordinate power receptacle location with the electrical contractor

D. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

E. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.

F. Install draining-type ground hydrants with 1 cu. yd. of crushed gravel around drain hole.

1. Set ground hydrants with box flush with grade.
2. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.

G. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

H. Install expansion joints on vertical risers, stacks, and conductors if indicated.

I. 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.

J. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

K. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

L. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

M. Install vent-flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

N. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

O. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

P. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

Q. Fasten recessed-type plumbing specialties to reinforcement built into walls.

R. Install wood-blocking reinforcement for wall mounting and recessed-type plumbing specialties.

S. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

T. Install air vents at piping high points. Include ball valve in inlet.

U. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

V. 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. Connect plumbing specialties to piping specified in other Division 22 Sections.

D. Ground equipment.

E. 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.

F. Connect plumbing specialties and devices that require power according to Division 26 Sections.

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-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Sections

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 CASEWORK

A. Install supply, drainage and vent, piping to and within the casework and hoods. Provide drops to casework and hoods and including final connection to the building service rough-in connection. This includes such items as gas, water or other supplies.

B. Plumbing equipment supports required with the casework shall be supplied and installed as part of the casework.

C. Sinks and fixtures that are not an integral part of the countertop such as epoxy or stainless steel sinks in chemical resistant counter tops shall be set as follows:

1. Stainless steel sinks complete as part of the Work under this Section.
2. Cutouts required for sinks, pedestal, faucets, service fixtures mounted on casework or countertops shall be made as part of the casework in the shop or field for use by the Contractor.

3.5 HANDICAPPED PLUMBING FIXTURE INSTALLATION

A. Installation of handicapped plumbing fixture must comply with Michigan Department of Labor - Barrier Free Design Rules (latest edition). Quantity and mounting heights of water closets, urinals, lavatories and drinking fountains must comply with rules in effect when project is being engineered.

3.6 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate on or near each backflow preventer.

1. Text: 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.
2. Refer to Section 15075 “Mechanical Identification" for nameplates and signs.

3.7 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1119

SECTION 22 4000 - PLUMBING FIXTURES

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 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, showerheads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.3 SUBMITTALS

A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

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"; about plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.

E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast Iron Fixtures: ASME A112.19.1M.
2. Hand Sinks: NSF 2 construction.
3. Plastic Mop-Service Basins: ANSI Z124.6.
4. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
5. Vitreous-China Fixtures: ASME A112.19.2M.
6. Water Closet, Flushometer: ASSE 1037, ANSI/ASME 112.19.6.
7. Urinal Flushometer: ASSE 1037, ANSI/ASME 112.19.6.

I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucet Hose: ASTM D 3901.
5. Faucets: ASME A112.18.1M.
6. Hose-Connection Vacuum Breakers: ASSE 1011.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
9. NSF Materials: NSF 61.
10. Pipe Threads: ASME B1.20.1.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
12. Supply and Drain Fittings: ASME A112.18.1M.

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 A112.18.1M.
3. Manual-Operation Flushometers: ASSE 1037.
4. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
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. Plastic Toilet Seats: ANSI Z124.5.
6. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. For fixture descriptions in other Part 2 articles where the subparagraph titles "Products," and "Manufacturers" introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.

2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in other Part 2 articles.

2.2 FIXTURE SUPPORTS

A. Wall Hung Lavatory Support, Type II, lavatory carrier with concealed arms and tie rod.

1. Manufacturers:

a. Zurn
b. Josam
c. Tyler Pipe, Wade Division
d. J. R. Smith
e. MI-Fab

2. Accessible Fixture Support: Include rectangular steel uprights.

2.3 WATER TEMPERING VALVES

A. Manufacturers:

1. Sparco, Inc.
2. Watts Industries, Inc.; Water Products Division
3. Conbraco Industries, Apollo Division 34D
4. Armstrong Rada
5. Wilkins
6. Symmons

B. General: Manually adjustable, thermostatically controlled water tempering valve; bronze body; and adjustable temperature setting ASSE1070.

C. System Water Tempering Valves: Piston or discs controlling both hot- and cold-water flow, capable of limited anti-scald protection. Include threaded inlets and outlet.

1. Finish: Rough bronze.

D. Limited-Volume, Water Tempering Valves: Solder-joint inlets and NPS 3/4 maximum outlet.

2.4 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Guard, Barrier Free/BF PSG-1: Manufactured, plastic covering for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements and ASTM E84.

1. Manufacturers:

a. Plumberex Pro-2000 Series
b. True Bro Lav-Guard
c. Sanitary Dash

2.5 LAVATORY FAUCETS

A. Lavatory Faucets, SF-1: 12” Gooseneck, two lever faucet with hot and cold levers.

1. Manufacturer:

a. Delta
b. American Standard

c. Eljer
d. Just Manufacturering Company, model J-1174-KS
e. Moen

2. Maximum Flow Rate: 1.5 gpm, unless otherwise indicated.
3. Body Material: Copper or brass underbody with brass cover plates.
4. Finish: Polished chrome plate.
5. Type: gooseneck
6. Centers: 8 inches.
7. Mounting: Deck, exposed.
8. Handle(s): Two.
9. Spout: Rigid.
10. Spout Outlet: Aerator.

2.6 LAVATORIES

A. Lavatories, LAV-1: Wall hanging, vitreous-china fixture. Fixture shall be installed to comply with all ADA requirements.

1. Manufacturers:

a. Kohler Company
b. American Standard, Inc. “Lucerne”, model 0355.012
c. Crane Plumbing/Fiat Products
d. Sloan

2. Type: With back.
3. Size: 21 x 18.
4. Faucet Hole Punching: Three, 4-inch centers, hole(s).
5. Faucet Hole Location: Top.
6. Color: White.
7. Faucet**:** LF-1.
8. Supplies: NPS 3/8 chrome-plated copper with stops.
9. Drain: Fixed grid strainer.
10. Drain Piping: Offset NPS 1-1/4 by NPS 1-1/2 chrome-plated cast-brass trap; 0.032-inch-thick tubular brass waste to wall; and wall escutcheon.
11. Protective Shielding Guard on Water and Drain Line: PSG-1.
12. Fixture Support: Concealed arms.
13. Mixing Valve: Water mixing valve.

2.7 SINK FAUCETS

A. Sink Faucet, SF-1: 12” Gooseneck, two lever faucet with hot and cold levers.

1. Manufacturer:

a. Delta
b. American Standard
c. Eljer
d. Just Manufacturering Company, model J-1174-KS
e. Moen

2. Maximum Flow Rate: 1.5 gpm, unless otherwise indicated.
3. Body Material: Copper or brass underbody with brass cover plates.
4. Finish: Polished chrome plate.
5. Type: gooseneck
6. Centers: 8 inches.
7. Mounting: Deck, exposed.

8. Handle(s): Two.
9. Spout: Rigid.
10. Spout Outlet: Aerator.

2.8 SINKS

A. Sink, LAV-1 & SK-1: Single bowl, undermount, self-rimming, “satin” finish, AISI Type 304 stainless steel, 18 gage. Coat underside with sound deadening non-marring mastic.

1. Manufacturers:

   a. Kohler
   b. Elkay- ELUHAD121255PD
   c. Just Manufacturing Company
   d. Crane

2. Type: Self-rimming.
3. Overall Rectangular Size: 14-1/2” x 14-1/2” x 5-1/2” deep inside bowl.
4. Faucet Hole Punching: Three, 4 inch centers, holes.
5. Faucet: SF-1.
6. Supplies: NPS 3/8 chrome-plated brass with stops.
7. Drain: Fixed grid strainer.
8. Drain Piping: NPS 1-1/4 by NPS 1-1/2 chrome-plated cast-brass trap; NPS 1-1/2, 0.045-inch thick tubular brass waste to wall; and wall escutcheon.
9. Provide ASSE 1070 mixing valve.

B. Sink, SK-2: Single bowl, undermount, self-rimming, “satin” finish, AISI Type 304 stainless steel, 18 gage. Coat underside with sound deadening non-marring mastic.

1. Manufacturers:

   a. Kohler
   b. Elkay- ELUH-1116DBG
   c. Just Manufacturing Company
   d. Crane

2. Type: Self-rimming.
3. Overall Rectangular Size: 14” x 18-1/2” x 7-7/8” deep inside bowl.
4. Faucet Hole Punching: Three, 4 inch centers, holes.
5. Faucet: SF-1.
6. Supplies: NPS 3/8 chrome-plated brass with stops.
7. Drain: Fixed grid strainer.
8. Drain Piping: NPS 1-1/4 by NPS 1-1/2 chrome-plated cast-brass trap; NPS 1-1/2, 0.045-inch thick tubular brass waste to wall; and wall escutcheon.
9. Provide ASSE 1070 mixing valve.

2.9 WATER CLOSET FLUSHOMETERS

A. Flushometer, WC-1: Cast-brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, and copper or brass tubing, and polished chrome-plated finish on exposed parts.

1. Manufacturers:

   a. Delany
   b. Sloan, model 111-1.6-YG-G
   c. Zurn

2. Internal Design: Diaphragm or piston operation.
3. Style: Exposed.
4. Inlet Size: NPS 1.
5. Trip Mechanism: Oscillating, lever-handle actuator.
6. Consumption: 1.6 gallons/flush.
7. Tailpiece Size: NPS 1-1/4 or 3/4 inch and standard length to top of bowl.

2.10 TOILET SEATS

A. Toilet Seat, TS-1: Solid plastic, with extended back with STA-TITE commercial fastening system.

1. Manufacturers:

a. Beneke
b. Church
c. Bemis
d. Kohler
e. Centoco

2. Configuration: Open front without cover.
3. Size: Elongated.
4. Class: Heavy-duty commercial.
5. Hinge Type: CC/SC, self-sustaining, check with STA-TITE commercial fastening system.
6. Color: White.

2.11 WATER CLOSETS

A. Water Closets, WC-1: Floor-mounting, floor-outlet, vitreous china fixture designed for flushometer valve operation. Fixture shall be installed to comply with all ADA requirements.

1. Manufacturers:

a. American Standard, Inc.
b. Crane Plumbing/Fiat Products
c. Kohler Company “Highcliff”, model K-96057
d. Sloan

2. Style: Close coupled.
3. Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
4. Height: Standard, barrier free accessible.
5. Design Consumption: 1.6 gallons/flush.
6. Color: White.
7. Supply: NPS 1-1/2 chrome plated brass or copper with loose-key stop.
8. Flushometer: WC-1.
9. Toilet Seat: TS-1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

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

3.2 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install water-less urinals per manufacturer’s requirements.

C. For wall-hanging fixtures, install off-floor supports affixed to building substrate.

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.

D. Install back-outlet, wall hanging fixtures onto waste fitting seals and attach to supports.

E. Install wall-hanging 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 manufacturers' written instructions and roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Section 22 0523 "General-Duty Valves" for general-duty valves.

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. 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.

L. Install toilet seats on water closets.

M. 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.

N. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

O. Install disposer in outlet of sinks indicated to have disposer.

P. 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. Refer to Section 15050 "Basic Mechanical Materials and Methods" for escutcheons.

Q. Set service basins in leveling bed of cement grout. Refer to Section 22 0510 "Basic Mechanical Materials and Methods" for grout.

R. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 07 Sections for sealant and installation requirements.

3.3 INSTALLATION OF WATER CLOSETS - BARRIER FREE

A. Mounting Heights:

1. Water Closets – Barrier Free: 18" from top of toilet seat to finished floor.

B. Flush Valve: Mount flush valve handle on wide side of stall/room. At every dual flush valve, sign shall be mounted over the center line of the flush valve and screwed to the wall in each corner.

C. Install the electric eye plate, flush with the wall as recommended per the manufactures installation directions. Mount the dual flush sign to the wall utilizing wall anchors and screws.

3.4 INSTALLATION OF LAVATORIES/SINKS - STANDARD AND BARRIER FREE

A. General: Unless otherwise noted on drawings, locate lavatory in compliance with ADA requirements.

B. Countertop: Coordinate with architectural trades.

C. Wall Hung: Conceal lavatory fixture support arms with deep drawn secure escutcheons. Securely bolt and anchor supports to the supporting surfaces.

D. Install a water tempering valve for each lavatory, kitchen hand sink and sink faucet.

3.5 INSTALLATION OF PLUMBING FIXTURES

A. Individual water line branches, waste lines, vents and traps for connection to individual fixtures, fixture fittings and specialties shall be per the following schedule or as indicated on drawings, whichever is greater (sizes are given in inches).

Item	Waste	Vent	Trap	Cold	Hot
Lavatory	1-1/2	1-1/2	1-1/4	1/2	1/2
Sink	1-1/2	1-1/2	1-1/2	1/2	1/2
Janitor/Service Sink	3	1-1/2	3	1/2	1/2
Wall Hydrant (Shower Rooms)	--	--	--	3/4	3/4
Wall Hydrant	--	---	--	3/4	---
Hose Bib	--	---	--	3/4	---

3.6 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 water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

F. Ground equipment.

1. 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.

3.7 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed 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.

3.8 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust disposers. Replace damaged and malfunctioning units.

C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

3.9 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.

3.10 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4000

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow and water flow within distribution systems to indicated quantities according to specified tolerances.
2. Adjusting total HVAC systems to provide indicated quantities.
3. Setting quantitative performance of HVAC equipment.
4. Verifying that automatic control devices are functioning properly.
5. Reporting results of the activities and procedures specified in this Section.

B. Related Sections include the following:

1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.3 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 design quantities.

C. 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.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. 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.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. 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.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

K. Test: A procedure to determine quantitative performance of a system or equipment.

L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

M. TDH: Total Dynamic Head

N. AABC: Associated Air Balance Council.

O. AMCA: Air Movement and Control Association.

P. CTI: Cooling Tower Institute.

Q. NEBB: National Environmental Balancing Bureau.

R. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.4 SUBMITTALS

A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.

B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.

C. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.

D. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

E. Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.

F. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

1.5 BALANCING CONTRACTORS

A. Only the following contractors will be allowed to provide air and water testing and balancing.

1. Absolut Balance
2. Air Flow Testing.
3. Ener-Tech Testing.
4. Enviro-Aire/Total Balance, Inc.
5. Hi-Tech Test and Balance
6. International Test and Balance
7. Mechanical Testing Services, Inc.

1.6 QUALITY ASSURANCE

A. Agent Qualifications: Testing, adjusting, and balancing agent shall be certified by either AABC or NEBB.

B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

a. Submittal distribution requirements
b. Contract Documents examination report
c. Testing, adjusting, and balancing plan
d. Work schedule and Project site access requirements
e. Coordination and cooperation of trades and subcontractors
f. Coordination of documentation and communication flow

C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.

D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."

E. Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

F. Testing, Adjusting, and Balancing Reports: Use standard forms from SMACNA's "HVAC Systems--Testing, Adjusting, and Balancing."

G. Testing, Adjusting, and Balancing Reports: Use testing, adjusting, and balancing Agent's standard forms approved by the Architect.

H. Instrumentation Type, Quantity, and Accuracy: As described in AABC National Standards or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

I. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.7 PROJECT CONDITIONS

A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.8 COORDINATION

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 testing, adjusting, and balancing activities.

B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.9 WARRANTY

A. General Warranty: The national project performance guarantee 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. National Project Performance Guarantee: Provide a guarantee on AABC'S "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

C. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified Agent 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 Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of the 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.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Architect's and Engineer's 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.

D. 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 the 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.

E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

F. Examine system and equipment test reports.

G. 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 their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

I. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

K. Examine strainers for clean screens and proper perforations.

L. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine equipment for installation and for properly operating safety interlocks and controls.

O. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices operate 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.
4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats 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 design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to design values.

P. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-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 design conditions for system operations can be met.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards and this Section.

B. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

C. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems--Testing, Adjusting, and Balancing" and this Section.

D. Cut insulation, ducts, 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 the insulation Specifications for this Project.

E. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. 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. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

L. Check for correct fan rotation.

3.5 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures are required for variable-air-volume. These additional procedures are specified in other articles in this Section.

B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each air-handling unit component.

a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Adjust fan speed higher or lower than design with the approval of the Architect. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.

D. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.

E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.

1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 VARIABLE-AIR-VOLUME SYSTEMS' ADDITIONAL PROCEDURES

A. Compensating for Diversity: When the total airflow of all terminal units is more than the fan design airflow volume, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the design airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge duct losses.
3. Measure total system airflow. Adjust to within 5 percent of design airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use the terminal unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

3.7 FUNDAMENTAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check expansion tank liquid level.
3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at design flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type, unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

8. Check air vents for a forceful liquid flow exiting from vents when manually operated
9. Check for correct pump rotation.

3.8 VARIABLE-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.

B. Adjust the variable-flow hydronic system as follows:

1. Verify that the differential-pressure sensor is located as indicated.
2. Determine whether there is diversity in the system.

C. For systems with no diversity:

1. Adjust pumps to deliver total design gpm.

a. Measure total water flow.

1) Position valves for full flow through coils.
2) Measure flow by main flow meter, if installed.
3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

b. Measure pump TDH as follows:

1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
3) Convert pressure to head and correct for differences in gage heights.
4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

2. Adjust flow-measuring devices installed in mains and branches to design water flows.

a. Measure flow in main and branch pipes.
b. Adjust main and branch balance valves for design flow.
c. Re-measure each main and branch after all have been adjusted.

3. Adjust flow-measuring devices installed at terminals for each space to design water flows.

a. Measure flow at terminals.
b. Adjust each terminal to design flow.
c. Re-measure each terminal after it is adjusted.
d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
e. Perform temperature tests after flows have been balanced.

4. Prior to verifying final system conditions, determine the system differential-pressure set point.

5. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
6. Mark final settings and verify that all memory stops have been set.
7. Verify final system conditions as follows:

    a. Re-measure and confirm that total water flow is within design.
    b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
    c. Mark final settings.

8. Verify that memory stops have been set.

D. For systems with diversity:

1. Determine diversity factor.
2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.
3. Adjust pumps to deliver total design gpm.

    a. Measure total water flow.

        1) Position valves for full flow through coils.
        2) Measure flow by main flow meter, if installed.
        3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

    b. Measure pump TDH as follows:

        1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
        2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
        3) Convert pressure to head and correct for differences in gage heights.
        4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
        5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

    c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

4. Adjust flow-measuring devices installed in mains and branches to design water flows.

    a. Measure flow in main and branch pipes.
    b. Adjust main and branch balance valves for design flow.
    c. Re-measure each main and branch after all have been adjusted.

5. Adjust flow-measuring devices installed at terminals for each space to design water flows.

    a. Measure flow at terminals.
    b. Adjust each terminal to design flow.
    c. Re-measure each terminal after it is adjusted.
    d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
    e. Perform temperature tests after flows have been balanced.

6. For systems with pressure-independent valves at terminals:

    a. Measure differential pressure, and verify that it is within manufacturer's specified range.
    b. Perform temperature tests after flows have been verified.

7. For systems without pressure-independent valves or flow-measuring devices at terminals:

    a. Measure and balance coils by either coil pressure drop or temperature method.
    b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.
9. Prior to verifying final system conditions, determine system differential-pressure set point.
10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
11. Mark final settings and verify that memory stops have been set.
12. Verify final system conditions as follows:

    a. Re-measure and confirm that total water flow is within design.
    b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
    c. Mark final settings.

13. Verify that memory stops have been set.

3.9 MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers
2. Motor horsepower rating
3. Motor rpm
4. Efficiency rating if high-efficiency motor
5. Nameplate and measured voltage, each phase
6. Nameplate and measured amperage, each phase
7. Starter thermal-protection-element rating

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.10 HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, and fan-coil units.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.

4. Voltage and amperage input of each phase at full load.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

3.11 TEMPERATURE TESTING

A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.12 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: 0 to plus 5 percent.
2. Air Outlets and Inlets: Plus 5 to minus 5 percent.
3. Heating-Water Flow Rate: Plus 5 to minus 5 percent.

3.13 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.14 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. Verify the following:

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.
6. 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 and the face velocity of filters and coils.
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 rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.15 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. 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. 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.

3.16 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-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 the instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to the 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 approved Shop Drawings and Product Data

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

1. Title page

2. Name and address of testing, adjusting, and balancing Agent
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 testing, adjusting, and balancing Agent who certifies the report
10. Summary of contents, including the following:

    a. Design versus final performance
    b. Notable characteristics of systems
    c. Description of system operation sequence if it varies from the Contract Documents

11. Nomenclature sheets for each item of equipment
12. Data for terminal units, including manufacturer, type size, and fittings
13. Notes to explain why certain final data in the body of reports vary from design values
14. Test conditions for fans and pump performance forms, including the following:

    a. Settings for outside-, return-, and exhaust-air dampers
    b. Conditions of filters
    c. Cooling coil, wet- and dry-bulb conditions
    d. Face and bypass damper settings at coils
    e. Fan drive settings, including settings and percentage of maximum pitch diameter
    f. Inlet vane settings for variable-air-volume systems
    g. Settings for supply-air, static-pressure controller
    h. Other system operating conditions that affect performance

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:

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

F. Apparatus-Coil Test Reports: For apparatus coils, include the following:

1. Coil Data: Include the following:

    a. System identification
    b. Location
    c. Coil type
    d. Number of rows
    e. Fin spacing in fins per inch
    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: Include design and actual values for the following:

    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

3. Test Data: Include design and actual values for the following:

a. Total airflow rate in cfm
b. Entering-air temperature in deg F
c. Leaving-air temperature in deg F
d. Air temperature differential in deg F
e. Entering-air static pressure in inches wg
f. Leaving-air static pressure in inches wg
g. Air static-pressure differential in inches wg
h. Low-fire fuel input in Btuh
i. High-fire fuel input in Btuh
j. Manifold pressure in psig
k. High-temperature-limit setting in deg F
l. Operating set point in Btuh
m. Motor voltage at each connection
n. Motor amperage for each phase
o. Heating value of fuel in Btuh

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data: Include the following:

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: Include the following:

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: Include design and actual values for the following:

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

H. 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: Include the following:

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. Design airflow rate in cfm
h. Design velocity in fpm
i. Actual airflow rate in cfm
j. Actual average velocity in fpm
k. Barometric pressure in psig

I. Air-Terminal-Device Reports: For terminal units, include the following:

1. Unit Data: Include the following:

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: Include design and actual values for the following:

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
g. Space temperature in deg F

J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data: Include the following:

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: Include design and actual values for the following:

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

3.17 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect and/or Owner.

B. Architect/Owner shall randomly select measurements, documented in the final report, to be rechecked. 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.

C. If 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."

D. 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.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, Architect may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.18 ADDITIONAL TESTS

A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION 23 0593

SECTION 23 0900 – INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections:

1. Division 20: Common Mechanical Requirements
2. Division 22: Plumbing
3. Division 23: Heating, Ventilating and Air-Conditioning (HVAC)
4. Division 26: Electrical
5. Division 28: Electronic Safety and Security

1.2 SUMMARY

A. This Section Includes:

1. Building Automation System (BAS), including controls for mechanical equipment to control temperature, humidity, ventilation, pressure, and other functions as indicated.
2. BAS Operator Interface System (OIS) including operator interface for monitoring and control of connected systems and equipment.
3. Refer to Drawings for Sequence of Operations and additional requirements related to this section.

B. Scope of Work:

1. The Mechanical Systems Controls Contractor (MSCC) shall provide and install all controls, sensors, wiring, control valves, dampers, electrical, and accessories as indicated and as necessary for a complete mechanical controls solution.
2. The MSCC shall complete systems integration of all new custom and packaged mechanical controls devices, and additional devices indicated in the project Drawings and Specifications, into the OIS.
3. The MSCC shall complete field installation of devices, wiring, and integration into the central OIS as indicated in project Drawings and Specifications for Units provided with packaged controls by the unit manufacturer.

1.3 DEFINITIONS

A. AE: Architect/Engineer.

B. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.

C. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.

D. BACnet Specific Definitions:

1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data 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. B-AWS: BACnet Advanced Operator Workstation
6. B-OWS: BACnet Operator Workstation
7. B-OD: BACnet Operator Display
8. B-BC: BACnet Building Controller
9. B-AAC: BACnet Advanced Application Controller
10. B-ASC: BACnet Application Specific Controller
11. B-LD: BACnet Lighting Device
12. B-SS: BACnet Smart Sensor
13. B-SA: BACnet Smart Actuator
14. B-RTR: BACnet Router
15. B-GW: BACnet Gateway
16. B-BBMD: BACnet Broadcast Management Device
17. B-GEN: BACnet General

E. BAS: Building Automation System.

F. 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.

G. 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 controllers, programmable application controllers, and application-specific controllers.

H. COV: Changes of value.

I. DDC: Direct Digital Control.

J. EEPROM: Electronically Erasable Programmable Read-Only Memory.

K. EPROM: Erasable Programmable Read-Only Memory.

L. E/P: Voltage to pneumatic.

M. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.

N. IP: Internet Protocol.

O. I/P: Current to pneumatic.

P. IT: Information Technology.

Q. LAN: Local Area Network.

R. LCC: Laboratory Controls Contractor.

S. LNS: LonWorks Network Services.

T. LON Specific Definitions:

1. FTT-10: Echelon Transmitter-Free Topology Transceiver.
2. LonMark International: 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 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 CTA-709.1-D protocol and that is connected to a CTA-709.1-D 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 CTA-709.1-D 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 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 CTA-709.3 and is most common media type for a CTA-709.1-D control network.
13. TP/XF-1250: High-speed, 1.25 Mbps, twisted-pair, doubly terminated bus network defined by "LonMark Interoperability Guidelines" and 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.

U. 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.

V. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.

W. Modbus TCP/IP: An open protocol for exchange of process data.

X. MSCC: Mechanical Systems Controls Contractor.

Y. MSTP: Master/Slave Token Passing.

Z. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.

AA. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.

BB. OIS: Operator Interface System.

CC. Peer to Peer: Networking architecture that treats all network stations as equal partners.

DD. PICS: BACnet Protocol Implementation Conformance Statement.

EE. RAM: Random access memory.

FF. RF: Radio frequency.

GG. Router: Device connecting two or more networks at network layer.

HH. Server: Computer used to maintain system configuration, historical and programming database.

II. SI: Systems Integrator.

JJ. TCP/IP: Transport control protocol/Internet protocol.

KK. UC: Unitary Controller.

LL. UPS: Uninterruptible power supply.

MM. USB: Universal Serial Bus.

NN. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.

OO. VAV: Variable air volume.

1.4 SYSTEM DESCRIPTION

A. Demolition Work: The MSCC shall visit the job site prior to, and during, the demolition phase to clearly identify and protect control tubes, wires, and devices necessary to keep the remaining systems active during the project phasing. Post construction demolition relative to control infrastructure shall be coordinated by this contractor with the construction manager and demolition contractor. All obsolete control equipment shall be removed from the site, unless otherwise noted on the drawings. The MSCC shall be responsible to repair visible architectural finishes surrounding demolished materials as necessary to match existing. The MSCC shall be responsible to ensure that any demolition activities involving existing site Controls Systems, field device networks, or Operator Interface Systems do not impact or alter the operation or performance of any existing site Systems or Equipment intended to remain.

B. New Work: Provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled on drawings and/or herein, including all labor, materials, equipment, and incidentals necessary and required to complete the installation of the controls for equipment as indicated on the drawings and herein described.

C. Provide a Building Automation System (BAS) incorporating Direct Digital Control (DDC), equipment monitoring, and control consisting of microcomputer based DCC Panels interfacing directly with sensors, actuators and environmental delivery systems (i.e., HVAC units, boilers, etc.); electric controls and mechanical devices for all items indicated on drawings, a primary communication network to allow data exchange from DDC panel to DDC panel; microcomputer based Unitary DDC Controllers (UCs) interfacing with sensors, actuators, and terminal equipment control devices; and a secondary communication network interfacing UCs to DDC panel network devices. The system shall be based on industry standard open protocols.

1. The Mechanical Systems Controls Contractor (MSCC) shall furnish and install a networked system of HVAC controls. The contractor shall incorporate direct digital control (DDC) for central plant engineering, building ventilation equipment, supplemental heating and cooling equipment and terminal units.
2. Provide networking to new DDC equipment using communication standards. System shall be capable of BACnet communication according to the most recent version of ASHRAE standard ANSI/ASHRAE 135 for interoperability with smart equipment and for the main IP communication trunk to the BAS server. The system shall not be limited to only standard protocols but shall also be able to integrate to a wide variety of third-party devices and applications via drivers and gateways.
3. Provide standalone controls where called for on the drawings or sequences.
4. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation, or identification number and sequence of operation all bearing the name of the manufacturer.

5. Furnish a complete distributed direct digital control system in accordance with this specification section. This includes all system controllers, logic controllers and all input/output devices. Items of work included are as follows:

    a. Provide a submittal that meets the requirements below for approval.
    b. Coordinate installation schedule with the mechanical contractor and general contractor.
    c. Provide installation of all panels and devices unless otherwise stated.
    d. Provide power for panels and control devices.
    e. Provide 120VAC circuits, wiring, and raceway as necessary to power all controllers and controls components. Power shall be provided from available circuit(s) within the nearest available electric distribution panel(s).
    f. Provide all low voltage control wiring and raceway for the DDC system.
    g. Provide miscellaneous control wiring for HVAC and related systems regardless of voltage.
    h. Provide engineering and technician labor to program and commission software for each system and operator interface. Submit commissioning reports for approval.
    i. Participate in commissioning for all equipment that is integrated into the BAS (refer to commissioning sections of the equipment or systems in other parts of this specification).
    j. Provide testing, demonstration and training as specified below.

D. Provide on-site supervision, calibration, and checkout of the control systems.

E. It is the responsibility of the Contractor to review the Drawings and specifications of all other trades concerning this project to determine what equipment is to be furnished and/or installed and/or connected by the Contractor in addition to that equipment called for in the project Specifications and Drawings.

F. Provide shop drawings as specified herein.

G. Provide guarantee as specified herein.

H. Provide classroom training instructions to Owner's operating and maintenance personnel as specified herein.

1.5 SUBMITTALS

A. Qualification Data:

1. Systems Provider Qualification Data:

    a. Resume of project manager assigned to Project.
    b. Resumes of application engineering staff and technicians assigned to Project.
    c. Descriptions of past projects completed, demonstrating required experience with projects of similar scope, size, and complexity.

2. Manufacturer's qualification data.

B. Product Data:

1. 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.
2. Include ASHRAE BACnet Conformance documents for each DDC system component (panel, zone controller, field devices, and operator workstation) proposed including the following:

    a. PICS Document
    b. BACnet Testing Laboratories Product Listing
    c. BACnet Testing Laboratories Conformance Certificate

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. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
3. Details of control panel faces, including controls, instruments, and labeling.
4. Written description of sequence of operation.
5. Schedule of dampers including size, leakage, and flow characteristics.
6. Schedule of valves including leakage and flow characteristics.
7. Trunk cable schematic showing programmable control unit locations and trunk data conductors.
8. Listing of connected data points, including connected control unit and input device. Input/output point summary with recommended set points.
9. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
10. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
11. Bill of materials to identify each control device.
12. A complete set of shop drawings shall be properly identified with the Engineer's project number and title. Shop drawings shall be 11" x 17" size (minimum).
13. Show interface with Work under other Contracts. Clearly illustrate, identify and define all components, assemblies, subsystems, and systems; relationship, interface, function, action, setting accuracy, range, sequence of operation, normal and abnormal conditions.

D. Commissioning Reports: Indicate results of startup and testing commissioning requirements. Submit copies of checklists.

E. Maintenance Data: For equipment to include in the maintenance manuals specified in Division 01.

F. Warranties: Special warranties specified in this Section.

G. No work shall be executed until the final submittals are approved by the project AE.

H. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise and submit Shop Drawings to reflect actual installation and operating sequences.

1.6 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details prior to installation.

B. Coordinate with the Mechanical Contractor for equipment provided with packaged controls including but not limited to field installation, wiring, and configuration of any supporting devices as necessary, and to complete integration to packaged unit controllers where indicated.

C. Coordinate with any auxiliary systems contractors to complete integration of auxiliary systems (i.e. Laboratory Controls, Lighting Controls, Power Monitoring, Security, etc.) into the central site Operator Interface System.

D. Coordinate locations and requirements for IT Data connections with the Electrical/Technology Contractor.

1.7 ACCEPTABLE MECHANICAL SYSTEMS CONTROLS CONTRACTORS

A. Acceptable Mechanical Systems Controls Contractors, subject to compliance with requirements of this specification and the project Drawings. Substitutions are not acceptable:

1. Control Net LLC

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is a certified installer of the automatic control system manufacturer for both installation and maintenance of units required for this Project, including a minimum of 2 years of documented experience with projects of similar scope and complexity.

B. Manufacturer Qualifications: A company experienced in manufacturing automatic temperature-control systems like those indicated for this Project and with a record of successful in-service performance, including a minimum of 5 years of documented experience.

C. Install all BAS components, devices, and wiring in compliance with NEC and all local electrical codes.

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 90A, "Installation of Air Conditioning and Ventilation Systems."

F. Comply with ASHRAE 135 for DDC system control components.

1.9 DELIVERY, STORAGE AND HANDLING

A. In strict compliance with the manufacturer’s written instructions and recommendations, materials shall be provided to ensure that all equipment and components are completely protected from damage, dirt, or weather during shipping, storage, prior to installation, and after installation for the duration of the construction activities.

B. 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 unit manufacturer.

1.10 WARRANTY

A. Contractor guarantees that this installation is free from defects and agrees to replace or repair, free of any charge to the satisfaction of the Owner's Representative any part of this installation including all components, parts and assemblies of the System which may fail within a period of one (1) year after final acceptance, provided that such failure is due to defects in the materials or workmanship or due to a failure to follow the specifications and drawings. The Contractor shall file with the Owner all guarantees from the equipment manufacturers and what operating conditions and performance capacities they are based on.

B. The Contractor shall initiate the warranty period by formally transmitting to the Owner commencement notification of the period for the system and devices accepted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers of DDC Controllers and accessories, subject to compliance with requirements of this specification and the project Drawings:

1. Honeywell Spyder

B. Provide a BAS Operator Interface System that is BTL Certified as a BACnet Advanced Operator Workstation (B-AWS) by the above listed manufacturers, or by Tridium (Niagara 4).

2.2 GENERAL

A. The MSCC shall provide a complete mechanical controls system including but not limited to programming, DDC controllers, software, sensors, transmitters, control valves, dampers, power supplies and wiring, network, gateways, routers, and all other devices required for a complete system.

B. The MSCC shall update the existing Owner Tridium/Niagara 4 BAS Operator Interface System (OIS) as necessary to facilitate remote monitoring and control of mechanical controls systems including but not limited to developed system graphics, point monitoring, point commanding, point trending, equipment operation schedule management, and system alarm configuration and annunciation. The MSCC shall provide a BACnet IP and/or MSTP field/floor level network or networks and shall connect all field devices to a BACnet B-BC controller or controllers. The B-BC controller(s) shall communicate with the BAS OIS server via the Owner's IP network.

C. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers, expansion modules, and operator devices.

D. System network architecture shall be completed such that each BAS controller shall operate independently by performing its own specified control, I/O, and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

E. Systems requiring multiple controllers (i.e. large chilled water plants) shall not utilize the Owner IP network for communication between common system controllers.

F. All controllers within a building shall be able to access any data from, or send control commands directly to, any other DDC controller or combination of controllers in the same building without dependence upon a central processing device (peer-to-peer).

G. All connected devices and systems must meet minimum Owner IT security requirements. The MSCC is responsible for remediation of any network security vulnerabilities identified by the Owner's IT department during the construction period and up to 1 year after project substantial completion.

H. All provided controls devices and systems shall be fully serviceable by Owner service technicians. The MSCC shall provide any applicable software tools, programs, and databases to the Owner service team as necessary to allow the Owner to self-perform full service and operation.

2.3 OPERATOR INTERFACE SYSTEM

A. General:

1. The MSCC shall complete systems integration of all new controls into the existing Owner centralized Tridium/Niagara 4 BAS Operator Interface System (OIS) to facilitate remote monitoring and control of mechanical controls system including but not limited to developed system graphics, point monitoring, point commanding, point trending, equipment operation schedule management, and system alarm configuration and annunciation. MSCC shall upgrade existing OIS as necessary to facilitate systems integrationThe MSCC shall review site network security requirements with the Owner's designated IT Support contact person and shall provide network security software and hardware components as necessary to meet site security requirements. Additionally, the MSCC shall provide network security software and hardware components as necessary to properly secure the BAS network and devices from other LAN connected devices.

B. Systems Integration: The MSCC shall complete integration of all new mechanical controls devices and devices indicated in the project Drawings and Specifications into the common central OIS, including but not limited to Mechanical Systems Controls, Laboratory Controls, Lighting Controls, Power Monitoring, Fire Alarm System, and Security Systems.

1. Points: Available points from connected field devices shall be integrated into the central OIS as follows:

   a. Mechanical Infrastructure Systems: Integrate all available points
   b. Mechanical Terminal Equipment and Packaged Equipment Controllers: Integrate all physical device input and output points, as well as system virtual setpoints and other control points as necessary to enable appropriate equipment operation and monitoring by central system operators. All available system points are not required for integration.

2. Graphics: Graphics shall be created and organized to allow a system operator to fully navigate system graphics via graphic buttons. Graphics shall include the following:

   a. Homepage including a map view of and click link buttons to all Owner sites connected to OIS.
   b. Homepage for each building including building photograph and click button links to all connected central building equipment, or equipment summary pages, and links to building floorplan graphics.
   c. Graphics shall include uploaded building key plan style floorplans for all building floors including room numbers. Floorplan graphics shall include key information (i.e.. room temperature) from and click button links to terminal equipment associated with each room.
   d. Do not display extraneous points (not pertinent) on viewable graphics or display screens.
   e. Written sequence of operation shall be included and shall be click linked to the associated equipment or system graphic for reference.
   f. For each building, include a comprehensive network architecture riser diagram including all connected devices for the site and showing connection to the central OIS server. Diagram shall indicate the active connectivity status of each connected device.
   g. All control contractor as built documents and product cut sheets shall be converted into .pdf files and made available through a link on the OIS graphics.
   h. Data to be displayed within a unique graphic shall be assignable regardless of physical hardware address, communication channel or point type. Graphics shall be on-line programmable and under password access control. Points shall be assignable to multiple graphics where necessary to facilitate operator understanding of system operation and where specified. Graphics shall also contain calculated or "software" points. Each physical point and each point assigned to a graphic shall be assigned an English descriptor for use in reports.
   i. Points shall be displayed with dynamic data provided by the system with appropriate text descriptor, status or value, and engineering unit. Coloration shall be used to designate alarm states, and status including point connectivity and override status. Coloration shall be variable for each class of points, as chosen by the Owner.
   j. Graphics shall include direct links to applicable system trend reports and views.
   k. An on-line "help" utility shall be provided to facilitate operator training and understanding. The "help" utility shall contain text and graphics to clarify system operation. At a minimum, help shall be available for every menu item and dialogue box.

3. Trends: System point trends shall be configured for connected systems as follows:

   a. Central Mechanical Equipment: Include trending for all main system points such as temperature, pressure, flow, valve command, damper command, setpoints, motor command and status, etc. Trends shall be change of value (COV) based including a maximum 1 hour time interval between recorded point values.
   b. Terminal Mechanical Equipment: Include trending for current room temperature, any unique terminal monitoring points such as carbon monoxide, carbon dioxide, etc., and any other critical terminal monitoring points as necessary.
   c. Auxiliary Systems: Include minimum baseline trending of key system operational and monitoring points.

4. Alarms: Configure system alarms for monitoring of all key operational parameters of all central mechanical systems and auxiliary systems, and terminal equipment monitoring points as necessary. Several examples of required system alarm points are included below:

    a. Fan or pump motor status does not match enable command for 10 seconds
    b. Boiler or chiller status does not match enable command for 10 seconds
    c. Equipment general alarm point has changed state to alarm status
    d. Air Handling Unit freezestat has tripped
    e. Air Handling Unit discharge air temperature is +/-5°F of setpoint during occupied mode
    f. Air Handling Unit end of duct static pressure is +/-0.5" WC of setpoint during occupied mode
    g. Air Handling Unit return air relative humidity is >70%RH during occupied mode
    h. Hydronic system liquid temperature is +/-5°F of setpoint when the system is enabled
    i. Hydronic system pressure is +/-5 psi of setpoint when the system is enabled
    j. Space/room temperature is <50°F or >90°F
    k. Area lighting status does not match enable command for 10 seconds

2.4 DDC CONTROLLERS AND ASSOCIATED COMPONENTS

A. DDC Controllers:

1. All BAS controllers shall use the latest version of ANSI/ASHRAE Standard 135 BACnet standard for communications, have passed BACnet Testing Laboratories (BTL) certification and be listed as compliant with UL916 Standard for Energy Management Equipment. BAS controllers used in smoke control applications must also be listed as compliant with UL864 Standard for Control Units and Accessories for Fire Alarm Systems.
2. All controllers shall be listed by BTL as conforming to the required standard device profile and support all of the minimum required BACnet Interoperability Building Blocks (BIBBs) associated with this device profile.
3. BAS controller types shall be one of three types, a BACnet Building Controller (B-BC), a BACnet Advanced Application Specific Controller (B-AAC) or a BACnet Application Specific Controllers (B-ASC).

    a. Building Controllers (B-BC) shall be used for all major mechanical equipment and/or systems (i.e. chilled water, heating hot water, large AHU's, etc.).
    b. Advanced Application Specific Controllers (B-AAC) shall be used, as an extension of a B-BC's performance and capacity, for control of all medium and small mechanical systems and/or terminal equipment.
    c. Application Specific Controllers (B-ASC) shall only be allowed to be used on terminal equipment including VAV boxes, FCU's, etc.

4. BACnet Building Controller (B-BC):

    a. Provide controllers conforming to the latest version of ANSI/ASHRAE 135 BACnet Building Controller (B-BC) standard device profile and support all of the minimum required BACnet Interoperability Building Blocks (BIBBs) associated with this device profile.
    b. Controllers shall support Internet Protocol (IP) for communications to other BC's and the OIS and MS/TP communication to B-AAC's and B-ASC's.
    c. Controllers shall have a 32 bit processor with an EEPROM, flash driven operating system. They shall be multi-tasking, multi-user, real-time digital control processors and permit I/O expansion for control / monitoring of up to 48 I/O. Controller size shall be sufficient to fully meet the requirements of this specification. Controllers shall be fully programmable while supporting standard energy management functions, including but not limited to:

        1) Alarm detection and reporting
        2) Automatic Daylight Saving Time switchover
        3) Calendar-based scheduling
        4) Closed loop PID control
        5) Duty cycling
        6) Economizer control

7) Equipment scheduling, optimization and sequencing
8) Event scheduling
9) Historical trend collection
10) Holiday scheduling
11) Logical programming
12) Reset schedules
13) Night setback control
14) Peak Demand Limiting (PDL)
15) Start-Stop Time Optimization (SSTO)
16) Temperature-compensated duty cycling
17) Temporary schedule override

d. Provide controller with integral power switch. If an integral switch is not provided by the manufacturer, the MSCC shall provide a separate dedicated transformer and switch within each enclosure for each controller present.

e. The operator shall have the ability to manually override automatic or centrally executed commands at the Building Controller via local, point discrete, hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points. These override switches shall be operable whether the panel processor is operational or not.

f. Controllers shall provide local LED status indication for power, communications, status and each digital output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.

g. All points associated with a given mechanical system (i.e., an air handling unit) will be controlled from a single Building Controller or point expansion panel(s) from the respective master. All expansion modules shall be located in the building controller enclosure or an attached enclosure. No points from a given mechanical system may be distributed among multiple panels - points must be run back to a single Building Controller dedicated to that mechanical system. Multiple mechanical systems shall be allowed on a single controller. Closed-loop control must never depend upon network communications. All inputs, program sequences, and outputs for any single BAS control loop shall reside in the same Building Controller.

h. A variety of historical data collection utilities shall be provided for manual or automatic sampling, storing and displaying system point data.

1) Building Controllers shall store point history data for selected analog and digital inputs and outputs:

i. Building Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control. Provide capability to view or print trend and tuning reports.

1) Loop tuning shall be capable of being initiated either locally at the Building Controller or from a network workstation. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

j. Provide controllers that, upon full system power recovery, all clocks shall be automatically synchronized, and all controlled equipment shall be automatically re-started based on correct clock time and sequence of operation.

k. Provide additional controllers or I/O modules if necessary, in each BAS panel so that each panel has at least 20% spare universal I/O capacity for connection of future points. Provide all processors, power supplies, and communication controllers so that the implementation of adding a point to the spare point location only requires the addition of the appropriate expansion modules, sensors/actuators and/or field wiring/tubing.

l. Controllers shall provide at least one data communication port for operation of operator I/O devices such as portable laptop operator's terminals. Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected printers or terminals. A USB port shall alternatively be available to support local HMI tools connection.

m. Field bus adaptors may be used, as an extension of the B-BC, to facilitate communication between the B-BC and remote field devices (sensors, actuators). Adaptors shall be microprocessor based and utilize advanced diagnostics and configuration. Adaptor shall be housed in panel or junction box enclosure.
n. Any provided JACE controllers shall be by Tridium Vykon and shall be fully open for Owner use and configuration without the need for any proprietary software or licenses.

5. BACnet Advanced Application Specific Controller (B-AAC):

a. Provide controllers conforming to the latest version of ANSI/ASHRAE 135 BACnet Advanced Application Specific Controller (B-AAC) standard device profile and support all of the minimum required BACnet Interoperability Building Blocks (BIBBs) associated with this device profile.
b. Controllers shall support MS/TP communication to B-BC's and other B-AAC's and B-ASC's. Also acceptable are B-AAC controllers that support Internet Protocol (IP) for communications to other BC's/ AAC's and the OIS and MS/TP communication to B-AAC's/ ASC's.
c. Controller shall be a microprocessor-based, 32 bit, multi-tasking, real-time digital control processor capable of stand-alone operation for medium sized mechanical systems and/ or control of roof-top units, VAV terminal units, CAV terminal units, dual-duct terminal units, fan-coil units, heat pump units.

1) If the hardware point requirements of any medium-sized system should exceed the I/O configuration of available B-AAC offerings then a B-BC must be used. Control of one piece of mechanical equipment may not be performed by more than one controller.

d. Controllers shall be peer-to-peer devices with hand/off/auto switches for each digital output. Switch position shall be supervised in order to inform the system that automatic control has been overridden. Switches will only be required for non-terminal applications (not required for VAVs, CAV's and other above terminal devices). All inputs and outputs shall be of the universal type, allowing for additional system flexibility.
e. Each controller shall support its own real-time operating system. Controllers without real-time clock functionality will only be permitted for use on terminal or unitary equipment such as VAV boxes, fan coil units and auxiliary monitoring and control.
f. Provide each controller with sufficient memory to accommodate point databases and operating programs. All databases and programs shall be stored in non-volatile EEPROM. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration.
g. Controllers must be fully programmable. All programs shall be field-customized to meet the user's exact control strategy requirements. Controllers utilizing pre-packaged or canned programs shall not be acceptable.
h. All points used for a single mechanical system shall be connected to the same B-AAC. Points used for control loop reset based on outside air, or space/zone temperature, or extremely remote differential pressure sensors on slow acting control loops are exempt from this requirement.
i. Provide spare additional I/O such that future use of spare capacity shall require providing only the field device, field wiring, point database definition and operational sequence programming changes as required. Additional point modules may be required to implement use of these spare points.

1) Provide at least one (1) spare universal input and one (1) spare universal output or 15% spare I/O of the total capacity of each B-AAC whichever is greater.
2) If B-AAC I/O is not universal then provide at least one (1) spare analog input, one (1) spare digital input, one (1) spare analog output and one (1) spare digital output or 15% spare I/O of the total capacity for each point type of each B-AAC whichever is greater.

6. BACnet Application Specific Controller (B-ASC):

   a. Provide controllers conforming to the latest version of ANSI/ ASHRAE 135 BACnet Application Specific Controller (B-ASC) standard device profile and support all of the minimum required BACnet Interoperability Building Blocks (BIBBs) associated with this device profile.
   b. Controllers shall support MS/TP communication to B-BC's, B-AAC's and other B-ASC's.
   c. Controller shall be a microprocessor-based, 32 bit, multi-tasking, real-time digital control processor capable of stand-alone operation for control of mechanical terminal units, i.e. VAV terminal units, CAV terminal units, air terminal units, dual-duct terminal units, fan-coil units, heat pump units and roof-top units.
   d. Each controller shall be capable of sharing point information with other B-BC, B-AAC, or B-ASC on a peer-to-peer basis via the BACnet network.
   e. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. All inputs and outputs shall be of the universal type (outputs may be utilized either as modulating or two-state). Analog outputs shall be industry standard signals such as 24V floating control and 0-10VDC allowing for interface to a variety of modulating actuators.
   f. Provide each controller with sufficient memory to accommodate point databases and operating and application programs. All databases and programs shall be stored in non-volatile EEPROM. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration.
   g. Each controller shall perform its primary control function independent of other BAS controller communications, or if communication is interrupted. Reversion to a fail-safe mode of operation during network interruption is not acceptable. Controller shall receive its real-time data from the Building Controller time clock to ensure network continuity.
   h. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) values for all applications. All PID values and biases shall be field-adjustable by the user via operator terminals.
   i. Controllers shall provide diagnostic LEDs for power, communications and processor status. The controller shall continually check the status of its processor and memory circuits
   j. All points used for a single mechanical terminal unit shall be connected to a dedicated B-ASC. Points used for control loop reset based on outside air, or space/zone temperature, or extremely remote differential pressure sensors on slow acting control loops are exempt from this requirement.
   k. Controllers shall perform and manage historical data collection. Minimum sampling time shall be configurable with a minimum sample rate of once per second. Controller shall store point history files for all analog and binary I/O's.

7. Controllers used for air terminal units (VAV's, CAV's, dual-duct mixing boxes):

   a. Provide electronic damper operators compatible with the controller and the air terminal units provided. Actuator shall utilize a brushless DC operator, min 35 in-lbs. of torque, floating control (unless noted otherwise).
   b. Controllers shall have an internal differential pressure transducer(s) capable of utilizing the total and static pressure signals from the air terminal unit's velocity sensor. Transducer shall be capable of 5% accuracy throughout its range of 0-1"wc. Associated velocity sensor shall be furnished by air terminal unit manufacturer.
   c. Each controller shall have electronic outputs compatible with the electronically operated air terminal unit tempering coil control valve and perimeter radiation control valve where applicable.
   d. Provide a discharge air sensor, mounted on the discharge of the terminal box reheat coil and/ or the outlet of dual duct mixing boxes, interfaced with the controller.
   e. Each controller shall include provisions for automatic calibration of the differential pressure transducer in order to maintain stable control and prevent drift over time. The method of stroking the terminal unit damper to a 0% position shall not be permitted should the controlled space(s) require constant pressurization that would be compromised if the controller would require closing the VAV box damper. MSCC shall provide alternate controllers, programming and/or auxiliary devices (i.e. an 'auto-zero' auxiliary device(s) which functions to temporarily disengage the transducer from the air velocity sensor so that a 0 cfm air volume reading is forced without changing the damper position) when serving these spaces to prevent negatively affecting room pressurization.

f. If coordinated with mechanical contractor, controllers shall be furnished to the unit manufacturer for factory mounting; otherwise, controls shall be field installed.
g. MSCC shall provide controllers with metal enclosure, complete with conduit knockouts.

8. Provide and fully implement the following application function (algorithms) in the BAS Panel. The following functions shall be operator assignable to each BAS panel.

a. Time and Calendar based Scheduled Operation
b. Automatic daylight savings time switchover
c. Optimum Start/Stop
d. Night Cycle Program
e. Night Purge Program
f. Reset Program for Set point Adjustment
g. Ventilation (Economizer) Program
h. Analog and Binary
i. Energy Calculations
j. Software Interlock
k. Trouble Diagnosis
l. Direct digital control loops for temperature control functions

B. Panel Enclosures:

1. Unitized cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Enclosures shall not be mounted directly on HVAC equipment such as air handling unit housings. Provide common keying for all panels.

a. Fabricate panels 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.

C. Networking Devices:

1. BACnet IP Routers:

a. BACnet router between MS/TP and B/IP (BACnet over IP) as well as a BBMD (BACnet Broadcast Management Device) for transportation of BACnet broadcasts over an IP network with several subnets.
b. Router shall comply with latest version of ASHRAE Standard 135 for communications.
c. Routers shall be UL864 listed when connected to BACnet MS/TP network segments that contain UL864 listed devices being used in a smoke control application.
d. Device shall be capable of routing BACnet packets over layer 3 IP network and shall support both the router and BACnet Broadcast Management Device (BBMD) networking options. BBMD shall support registrations by Foreign Devices.
e. 24 VAC power supply required for router(s) shall be provided by the MSCC.
f. Device shall be password protected with customizable password and security settings.

D. Power Supplies:

1. Power to controllers and associated controlled devices shall be 24 VAC, provided by the MSCC. Unless otherwise noted, power source (i.e. normal vs. emergency power) shall match that of the equipment being controlled.
2. Provide each DDC panel with a line filter, surge suppressor, electrical disconnect, control fuse, and control transformer. All sized and provided by the MSCC.
3. Provide fully enclosed power supplies located inside control enclosures with external 24 Vac terminals, on/off control, equipment overcurrent protection, power indication, high/low voltage separation, and convenience 120VAC outlets.
4. Provide insulated, modular, feed-through, clamp-style terminal blocks suitable for rail-mounting with end plates and partitions for the termination of all field wiring in control enclosures. Field wiring to

equipment with integral terminals and/or unitary equipment (i.e., VAV's, EF's, etc.) shall not be required to have terminal blocks.

5. Provide a minimum of 72 battery backup hours for complete system RAM memory and clock, with automatic battery charger. The backup power source shall have sufficient capacity to maintain volatile memory in event of an AC power failure.

2.5 ACTUATORS AND OPERATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action as indicated.

1. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
2. Non-spring Return Motors for Valves Larger than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
3. Spring-Return Motors for Valves Larger than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
4. Non-spring Return Motors for Dampers Larger than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
5. Spring-Return Motors for Dampers Larger than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Damper or Large-Valve Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Valves: Size for torque required for valve close-off at maximum pump differential pressure.
2. Dampers: Size for running torque calculated as follows:

    a. Parallel-Blade Damper with Edge Seals: 7 inch pounds/sq. ft. of damper.
    b. Opposed-Blade Damper with Edge Seals: 5 inch pounds/sq. ft. of damper.
    c. Parallel-Blade Damper without Edge Seals: 4 inch pounds/sq. ft of damper.
    d. Opposed-Blade Damper without Edge Seals: 3 inch pounds/sq. ft. of damper.
    e. Dampers with 2 to 3 Inches wg of Pressure Drop or Face Velocities of 1,000 to 2,500 FPM: Multiply the minimum full-stroke cycles above by 1.5.
    f. Dampers with 3 to 4 Inches wg of Pressure Drop or Face Velocities of 2,500 to 3,000 FPM: Multiply the minimum full-stroke cycles above by 2.0.

3. Coupling: V-bolt and V-shaped, toothed cradle.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
6. Temperature Rating: Minus 22 to plus 122 deg F.
7. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
8. Run Time: Maximum 90 seconds
9. Fast Acting Actuator Run Time: Maximum 10 seconds

2.6 CONTROL VALVES

A. Valves shall be provided according to the details of this section, and in compliance with the related specification section "Valves".

B. Valves shall be factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Valves shall be sized based on indicated system design flowrates, pressures, and temperatures.

D. Valves and actuators shall be selected with suitable close-off pressures for the application.

E. Unless indicated otherwise, valve bodies NPS 2 inches and smaller shall be bronze with screwed end connections. Valve bodies NPS 2-1/2 inches and larger shall be cast iron with flanged end connections.

F. Manufacturer: Unless noted otherwise, valves shall be Belimo, Honeywell, Johnson, Siemens, or approved equal.

G. Ball Valves (Water):

1. Fluid: Chilled or hot water (up to 50% glycol)
2. Pressure rating: 125 psi water
3. Temperature rating: 250°F water
4. Materials:

   a. Valve body: Bronze
   b. Seat: PTFE
   c. Seals: EPDM
   d. Ball: Nickel or chrome plated brass

5. Sizing: 5 psig maximum pressure drop at design flow rate.
6. Modulating valve flow characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

H. Control Valve Systems Application:

1. Hydronic heating or chilled water:

   a. 2 position valves:

      1) 2 inch and smaller: Ball valve
      2) 2-1/2 inch and larger: Resilient seated butterfly valve

   b. Modulating valves:

      1) 2 inch and smaller: Ball valve
      2) 1 inch to 6 inch: Globe valve
      3) 4 inch and larger: High performance butterfly valve

2.7 CONTROL DAMPERS

A. Dampers: AMCA-rated, airfoil type parallel and opposed-blade design by an ISO 9001 accredited manufacturer; 13 gauge minimum, galvanized-steel frames; damper blades shall not be less than 16 gauge galvanized steel or aluminum with maximum blade size of 8 inches wide and 48 inches long.

1. Unless otherwise noted, dampers intended for two position operation shall be parallel blade, and dampers intended for modulating control shall be opposed blade.
2. Face and bypass dampers shall be sized to pass 100% of the associated unit rated airflow.
3. Provide required drive axles, linkage, jackshafts, and accessories for proper damper operation. All linkages shall be located outside of the airstream.
4. Damper blades, frames, linkages, jackshafts and other parts of the damper actuation system shall not distort or rack during operation.
5. Dampers shall close tightly, and operate in a smooth, hesitation and slack-free manner over the entire range of travel, at the maximum air pressure and velocity at the mounting location.
6. Multiple section dampers shall operate in unison section-to-section.
7. Dampers shall include blade and edge seals as necessary to achieve maximum leakage of 4 CFM per sq. ft. of damper area at 1.0” WC pressure.
8. Operating Temperature Range: From minus 40 to plus 200 deg F.

9. Static Pressure Rating: Shall be selected to withstand the maximum pressure to be encountered upon closure at the installation location, but not less than 4.0” WC.
10. Dampers shall be supported by properly reinforcing the ductwork at damper locations to carry the weight of the dampers, or shall be supported independent of ductwork, from the structure or floor as conditions at the site dictate. Both sides of damper frame shall be caulked.
11. Dampers which will be exposed directly to weather shall have stainless steel axles, bearings, bushings, and fittings. Dampers which open directly to outdoors from a room such as mechanical or electrical room ventilation, shall include 1" of 1-1/2 lb. density insulation sandwiched in 16 gauge zinc coated steel blades. Bearings shall be oilite bronze.
12. Manufacturers: Dampers shall be Ruskin, Vent Products, or approved equal. Use insulated dampers as indicated on the drawings.

2.8 TEMPERATURE AND HUMIDITY INSTRUMENTS

A. Temperature Sensors:

1. Resistance Temperature Detectors (RTD): Platinum.

   a. Single point duct mounted RTD shall be rigid bulb type, with probe length selected accordingly for measurement near center of the duct cross sectional area
   b. Averaging point duct mounted RTD sensor probe(s) shall be selected to appropriately cover the full duct/coil cross sectional area at the location of installation
   c. Outside air RTD shall have sun shield to minimize solar effects and shall be mounted to minimize building outside air film effects
   d. Immersion Type - shall be suitable for immersion into fluids in pipes with separable well and heat transfer compound, which shall be compatible with the sensors
   e. Space temperature with a range of 55 to 95 degF, plus or minus 0.5 degF resolution, for conditioned space. Space temperature sensors installed at building exterior entrances shall include temperature sensing down to 20 degF for freeze risk monitoring.
   f. Duct temperature with a range of 20 to 120 degF, plus or minus 0.5 degF resolution
   g. Outside Air (OA) temperature with a range of minus 40 to plus 130 degF, plus or minus 2 degF resolution
   h. Liquid immersion temperature sensors shall include probe with SS well, and weather tight enclosure. Sensors shall include a calibrated span of 20 to 120 degF or 30 to 250 degF for heating applications.

2. Sensors installed in wet service locations (i.e. natatorium, piping tunnels, etc.) shall be waterproof and shall be resistant to chlorine and other cleaning agents. Sensors shall have rust proof and waterproof covers.

B. Thermostat:

1. DDC Thermostat: Thermostat for connection to DDC controllers.

   a. Space temperature sensor with a range of 55 to 95 degF, plus or minus 0.5 degF resolution. Thermostats installed at building exterior entrances shall include temperature sensing down to 20 degF for freeze risk monitoring.
   b. Digital temperature display
   c. Temperature setpoint adjustment
   d. Override button
   e. Provide with auxiliary communications port to allow remote connection to DDC controllers.
   f. Thermostat shall be provided with additional options and features as necessary to accommodate functions detailed in the project drawings.

2.9 FLOW INSTRUMENTS

A. Airflow:

1. Duct Mounted Airflow Measuring Station:

a. Provide where indicated, airflow measuring station(s) capable of continuously monitoring the air volume capacities in which they serve.
b. Individual airflow traverse probes are not acceptable.
c. Station shall not be provided with integral air straightener, unless required by ductwork location. If installed ductwork cannot facilitate manufacturer recommended straight duct lengths without straightener, Contractor shall submit an RFI to the project Engineer for direction.
d. Velocity Pressure Type Airflow Measurement:

1) Each airflow traverse probe mounted within the station shall contain multiple total and static pressure sensors located along its exterior surface, and internally connected to their respective averaging manifolds. The flow sensors shall not protrude beyond the surface of the probe(s), and shall be the offset (Fechheimer) type for static pressure and the chamfered impact type for total pressure measurement. The airflow station's measured accuracy shall not be affected by directional flow having yaw and/or pitch angles up to 30º.
2) The airflow measuring station(s) shall have a 14 ga. [18 ga. for circular units] galvanized steel, 6" deep welding casing with 90deg connecting flanges. Total and static pressure sensors shall be located at the centers of equal areas (for rectangular ducts) or at equal concentric area centers (for circular ducts) across the station's face area.
3) Stations shall be AMCA certified and be capable of measuring the airflow rates within an accuracy of ±2% without the use of correction factors. The maximum allowable unrecovered pressure drop caused by the station shall not exceed .025" w.c. at 2000 FPM, or .085" w.c. at 4000 FPM.
4) The transmitter shall be capable of receiving flow signals (total and static pressure) from an airflow station or probe array and produce dual outputs linear and scaled for air volume, velocity, differential pressure, etc.
5) The transmitter shall contain an integral multi-line digital display for use during the configuration and calibration process, and to display one transmitter output 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 will be available in multiple natural spans covering the range of 0.05 IN w.c. to 10.0 IN w.c. with an accuracy of 0.1% of natural span. The transmitter shall be furnished with a transducer automatic zeroing circuit and be capable of maintaining linear output signals on applications requiring 10 to 1 velocity (100 to 1 pressure) turndown.
7) The transmitter shall be capable of having its operating span electronically selected without having to perform recalibration involving an external pressure source.

2.10 ELECTRICAL COMPONENTS AND ACCESSORIES

A. Components:

1. Control Relays:

a. Control relays shall be provided with two spare, unused contacts, one normally opened and the other normally closed.
b. All relays shall be plug-in interchangeable mounted on a circuit board and wired to numbered terminal strips.
c. Start/stop relay module shall provide either momentary or maintained switching action as appropriate for the motor being started.

2. Current Switches:

a. Current Sensing Switches (CS): CS shall be utilized for monitoring motor operation. Switch shall be adjustable so that a contact closure is made any time the motor is operating within a "normal" range (1.25-50 amps). Low motor amps resulting from low loading or belt failure shall indicate "OFF". Induced current from the motor power feed shall power CS. The CS shall provide visual indication (LED's) for output status and sensor power; shall have an adjustable trip set-point to ± 1% of its range from -15 to 60°C; shall be isolated to 600 VAC rms; shall be a self gripping split-core type with an optional drill mount bracket; output shall be N.O., solid state, 1.0 A at 30 VAC/DC with a minimum aperture of .52" x .68" for motor power feed. CS shall be a Hawkeye model #H-608 as supplied by Veris Industries, Inc. or equal.

b. Motor Status: The contractor shall provide and install a current sensing switch on any motor required to have motor status. The split-core current switch shall be clamped around one of the three phase motor conductors. The contractor shall adjust the switch per the manufacturer's recommendations to provide status only when the motor driven device (fan, pump, etc.) is operating normally.

B. Wiring and Conduit:

1. Control wiring and cabling shall be per National Electrical Code (NEC) requirements and equipment manufacturer's recommendation and requirements of the mechanical control systems.

2.11 PNEUMATIC COMPONENTS AND ACCESSORIES

A. Tubing:

1. Copper tubing shall be new hard drawn, air grade, ASTM B75 for 3/8 inch and smaller or type L, ASTM B68 for 1/2 inch and larger, with solder joint or compression type fittings, at the option of the MSCC.
2. Plastic tubing (all sizes) shall be black virgin, polyethylene, ASTM D1248, Type 1, Class C, Grade 5, meeting crack test performance required by ASTM D1693 and be fire retardant (FR) rated. Multi-tube harness material shall be as specified above with a polyester film barrier and vinyl jacket not less than 0.062 inches thick. All non-metallic tubing shall be 1/4" O.D. minimum; micro-sleeve is not acceptable.

B. Differential Pressure Gauges:

1. Description:

a. 2000 Series magnahelic differential pressure gauges shall provide an accurate indication of positive, negative, or differential air pressure. The gauge shall include a 4" (10.2 cm) easy to read dial and frictionless magnetic movement in cast aluminum housing and be resistant to shock, vibration, and overpressure. The 2000 Series has both back and side connections so that it may be either surface or flush mounted. Ranges are available from 0" to 0.25" W.C. up to 10" W.C. Select gauge for normal reading to be not less than 25% of full scale.

2. Features:

a. 2% full scale accuracy
b. Easy to read 4" (10.16 cm) white dial and red tipped pointer
c. Flush or surface mounting
d. Easily accessible zero adjustment
e. Corrosion resistant cast aluminum housing
f. Back and side connections

3. Specifications:

   a. Accuracy: ± 2% of FS (3% on -0 and 4% on -00 ranges) throughout range @ 70 °F (21 °C).
   b. Overpressure: Relief plug designed to open at 25 psig (172 kPa).
   c. Ambient Temperature: 20 °F to 140 °F (-7 °C to 60 °C).
   d. Rated Total Pressure: -20” Hg to 15 psig (103 kPa).
   e. Connections: 1/8” NPT female high and low pressure taps, duplicated-one pair side and one pair back.
   f. Housing: Die-cast aluminum, case and aluminum parts iridate-dipped to withstand 168 hour salt spray test, baked dark gray hammerloid exterior finish.
   g. Standard Accessories: Two 1/8” NPT plugs for duplicate pressure taps, two 1/8” pipe thread to rubber tubing adapters, and three flush mounting adapters with screws.
   h. Weight: 1.0 lb. (2.0 oz).
   i. Warranty: 1 year.

C. Pneumatic/Electric Relays:

1. Electric, two position type, range and element shall be suitable for the service. Single or two pole, normally open or normally closed as required. Pneumatic signal setpoint shall be adjustable over the full range. Switch rating shall be 15 amps at 120 VAC.

D. Electric/Pneumatic Relays:

1. Electric, two position type, range and element shall be suitable for the service. Shall be suitable for field or panel mounting, have a 120 VAC coil, and 3 or 4 ports as applicable.

E. Electric/Pneumatic Transducers:

1. Transducers shall convert electronic signals from the DDC controller to linear proportional pneumatic signals for all DDC controlled modulating pneumatic devices.
2. Shall be a panel-mounted device with hand/auto switch, override dial for manual override control, and an output pressure gauge.
3. Shall be selected with a pneumatic output signal range to match the pneumatic actuators served.
4. Output accuracy shall be 1/4 psig at 75°F.
5. Shall be high capacity non-bleed devices with a minimum output capacity as necessary for the application, except special circumstances that require a constant bleed controller with branch exhaust on signal loss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Label every single control device and component including, but not limited to, space sensors, well sensors, AFS’s, control panels, damper actuators, VAV box controllers, valves, outdoor air sensors, relays, pressure sensors, differential pressure transmitters, pressure switches, etc. Label must include plain English descriptor and BAS point ID that matches the ID on the OWS exactly.

B. Verify that conditioned power supply is available to control units and operator workstation.

C. Verify that duct-, pipe-, and equipment-mounted devices and wiring and pneumatic piping are installed before proceeding with installation.

3.2 COMMISSIONING

A. This contractor shall make available a qualified technician that is familiar with the installation of this job for technical assistance to the commissioning engineer. No additional paperwork or reports will be required by this process. Where multiple operations in multiple locations are required to test equipment affected under this contract, the appropriate number of staff shall be required.

3.3 INSTALLATION

A. Install equipment level and plumb.

B. Install software in control units and OIS. Implement all features of programs to specified requirements and as appropriate to sequence of operation.

C. Connect and configure equipment and software to achieve the sequence of operation specified.

D. Verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Locate all 48 inches above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

E. Install guards on thermostats in the following locations:

1. Entrances
2. Public areas
3. Where indicated

3.4 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Control wiring in exposed areas and within walls shall be in conduit or EMT as specified in the Electrical Requirements - Division 26.

B. Low voltage control wiring in plenum areas and ceiling cavities shall be plenum rated cable installed parallel or perpendicular to the building structure. Install control wire in bridle rings every 10’ and change in direction. Label control wire as such at each bridle ring. **This item will be strictly enforced.**

C. Space sensor wires that cannot be run within a wall cavity shall be run in one-piece steel surface raceway (Wiremold V500 or equal) and painted to match the existing finish. Fill and patch any cavities left by previous sensors. Paint to match existing finish.

3.5 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Install piping adjacent to machine to allow service and maintenance.

B. Ground equipment.

1. 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.

3.6 SENSORS, RELAYS, CONTROLS AND ASSOCIATED COMPONENTS

A. Location – Accessibility:

1. Locate controls, relays, instruments, switches, valves, devices and accessories so they are readily accessible for adjustment, service and replacement or as indicated. Conceal tubing, sensing lines, cables and capillaries in all areas except equipment rooms and other unfinished spaces. Install and route tubing, sensing lines, cables, capillaries and conduits parallel and perpendicular to building steel in parallel banks with changes of direction made at 90 degree angles.

B. Location – Sensing Air:

1. Locate, size, and support temperature sensing elements in air streams to properly sense the representative temperature. In the case of controlling, transmitting and indicating elements, the sensing device shall be located, sized and of the type to sense the average condition. In case of safety elements, the sensing device shall be located and of the type to sense the extreme condition.
2. Sensing elements in double wall casings and insulated ducts shall have the entire active portion within the air stream.

C. Insulation:

1. Where insulation is penetrated due to the installation of sensing elements or tubing, reseal the openings air and vapor tight. Where control devices are to be located on insulated surfaces, provide brackets to clear the finished surface of the insulation avoiding punctures of the vapor seal.

3.7 VIBRATION ISOLATION

A. Components:

1. Provide vibration isolation for controllers and components, either by location or by mounting devices.

B. Conduit and Tubing:

1. Install tubing and conduit to preclude nullification of provisions for vibration isolation of equipment and ducting. Mount single tube runs in aircraft type clamps containing an elastomer insert. Mounting shall prevent contact with ducting and air handling unit housing, casing or enclosure. Multiple runs shall conform to the same isolation requirements but details of mounting shall be submitted for approval. Provide looped rubber hose connection when tubing crosses flexible duct and equipment connectors.

3.8 FASTENING TO BUILDING STRUCTURES

A. The methods of attaching or fastening equipment or equipment supports or hangers to the building structure shall be subject to approval by the AE. Submit shop drawings or samples for approval before proceeding with the work.

B. Drilling, welding or the use of explosive driven fasteners on building structures shall require written prior approval by the AE for each type of application except where indicated.

C. Equipment shall not be attached to or supported from the roof deck, from removable or knockout panels, or temporary walls or partitions.

D. Electrical equipment mounted against exterior masonry walls shall be mounted at least 1 inch away from the wall surface.

3.9 FIELD QUALITY CONTROL

A. After the inspection has been completed, check systems for continuity.

B. After completion of system installation, the Contractor shall test, adjust, and readjust as necessary, all control equipment in terms of design, function, systems balance, performance, and otherwise make ready for air handling systems acceptance tests.

C. After systems acceptance and after the systems have operated in normal service for two weeks, check the adjustment on instruments and devices and correct items found to be out of order. When systems are in specified operating condition, and other pertinent specifications have been complied with, temperature

control systems will be accepted for heating, ventilating and air conditioning systems. Readjustments necessary to accomplish the specified results shall be made during the warranty period upon request.

D. Coordinate with system manufacturer's representative the time of the final system check.

E. Provide equipment to check the calibration of instruments. Instruments not in calibration shall be recalibrated to function as required, or shall be replaced.

F. Calibrate and adjust control devices, linkages, accessories, and components for stable and accurate operation to meet the design intent and to obtain optimum performance from the equipment controlled. Final adjustment, calibration and checking shall be performed while the respective controlled systems are in full operation. Cause every device to automatically function as intended to ensure its proper operation.

G. After calibrations, adjustments, and checking have been completed and systems are operational, demonstrate to the administrative authorities having jurisdiction and to the AE the complete and correct functioning of all control systems and equipment. These demonstrations shall consist of operating the controls through their normal full ranges and sequences. Simulate abnormal conditions to demonstrate proper functioning of safety devices. Readjust settings to their correct design values, and after sufficient time, observe ability of controls to establish the desired conditions, noting abnormal deviations. Make necessary repairs, replacements or adjustments on items which fail to perform satisfactorily and repeat tests to demonstrate compliance with the design intent.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain control systems and components.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs.
3. Review data in maintenance manuals.
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.11 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

3.12 OWNER’S INSTRUCTION

A. The MSCC shall Provide a training program encompassing equipment and systems for client's operating and maintenance personnel. Coordinate training schedule with the Owner.

B. Training staff shall include Contractor's personnel supplemented by equipment manufacturer's engineering representative.

C. Utilize corrected equipment and system shop drawings, manuals, demonstration apparatus and installed, functioning equipment.

D. During system commissioning and when acceptable performance of the system hardware and software has been established, provide on-site operator and maintenance personnel instruction. Instruction shall be by acceptable competent Contractor Representatives familiar with the systems and computer software, hardware, and accessories.

E. Provide 1 hours of "classroom" instruction to the client's personnel on the operation of DDC System equipment. Operator instruction shall include the overall operational program, equipment functions (both individually and as part of the total integrated system), commands, advisories, and appropriate operator intervention required in responding to the systems operation. Use the operating and maintenance manuals described above as texts during the instructional period. Instruction shall also include description of the chronological information flow from field sensors, contacts and devices to the DDC System. The overview of the system's communication network shall be to provide an understanding to the client's personnel of the interplay between initiating devices, data gathering locations, loop communications and their importance within the DDC System.

END OF SECTION 23 0900

SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Ductwork Construction and Application Schedule
2. Ductwork materials, plenums, construction, fabrication and support
3. Galvanized steel ductwork
4. Round and flat oval ductwork
5. Reinforcing and supports
6. Flexible nonmetallic duct
7. Double-walled panels, plenums, and duct at outside air intake plenums
8. Blank-off panels for unused louver areas
9. Bellmouth connections
10. Duct liner
11. Duct sealants
12. Duct cleaning and disinfecting
13. Duct installation, sealing, inspection, and leakage testing

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", 2005 and performance requirements and design criteria indicated in the “Ductwork Construction And Application Schedule” that follows in this Section.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", 2005.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Project specific duct fabrication schedule including materials, methods of installation, and location of fitting types. Indicate the metal gage and reinforcement method intended for each pressure classification and size of duct.
2. Construction details for double wall duct and panels, plenums, stacks, canopy hoods, etc.
3. Double wall duct and panel fill material
4. Hangers and supports
5. Duct fittings (manufacturer supplied and contractor fabricated)
6. Turning vanes
7. Duct sealant
8. Flexible duct

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Duct layout indicating sizes, configuration and static-pressure classes.
3. Elevations indicating top and bottom height of ducts.
4. Dimensions of main duct runs from building grid lines.
5. Penetrations through fire-rated and other partitions.
6. Equipment installation based on equipment being used on Project.
7. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
8. Hangers and supports, including methods for duct and building attachment

1.5 QUALITY ASSURANCE

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the following quality assurance standards; latest editions, unless noted otherwise.

C. ASTM A653 / A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM A 666 – Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, And Flat Bar.

E. ASTM B 209 & 209M – Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.

F. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems.

G. NFPA 90B – Standard for the Installation Of Warm Air Heating and Air Conditioning Systems.

H. SMACNA – All standards

I. AWS - All applicable standards

J. UL 181, 181A, & B – Factory-made Air Ducts and Connectors and Closure Systems

K. UL 723 – Standard for Surface Burning Characteristics of Building Materials

L. Air Diffusion Council – Flexible Duct Performance and Installation Standards

M. National Air Duct Cleaners Association (NADCA).

PART 2 - PRODUCTS

2.1 GENERAL

A. Provided duct and fittings of G90 galvanized steel unless otherwise indicated.

B. Construct duct and fittings in compliance with SMACNA standards and recommendations and per the additional requirements indicated.

C. Duct dimensions indicated on drawings are inside dimensions. The sheet metal dimensions shall be increased an equivalent amount to accommodate internal liner where liner is indicated.

D. Drawings are diagrammatic and indicate the arrangement of the principal apparatus and ductwork and shall be followed as closely as possible. All the required offsets, rises, drops, fittings and accessories may not be indicated on the drawings, but shall be provided as required for a complete and fully functional system. Carefully investigate structure, finish conditions, and the work of other trades affecting sheet metal work, including work associated with testing, adjusting and balancing, in order to arrange all items accordingly. Provide best possible arrangement to provide maximum headroom and maintenance clearances.

E. In addition to sheet metal ductwork specified herein, provide or install as furnished by other sections, accessories and devices including, but not limited to, smoke detectors, plenums, canopy hoods, control dampers, and blank-off panels at unused louver areas.

F. Provide intake and exhaust/relief air plenums attached to louvers.

G. Alternate Joining Methods: As an alternate to SMACNA joining methods, Contractor may propose proprietary joining systems with performance equivalent to SMACNA for Owner's review and approval.

DUCTWORK CONSTRUCTION AND APPLICATION SCHEDULE

GENERAL SUPPLY/RETURN/TRANSFER/EXHAUST DUCTWORK

DUCT	PRESSURE CLASS (IN. W.G.)	SMACNA SEAL CLASS	ASHRAE LEAK CLASS	MATERIAL	NOTES
EXHAUST DUCTWORK	-2	A	3	G-90	---
PLENUMS	± 2	A	3	SAME AS DUCTS SERVED	---
ALL OTHER SUPPLY/RETURN/EXHAUST NOT SPECIFICALLY IDENTIFIED	± 2	C	N/A	G-90	---

ABBREVIATIONS
EF = EXHAUST FAN
FCU = FAN COIL UNIT
RF = RETURN FAN
TAU = TERMINAL AIRFLOW UNIT

2.2 DUCTWORK MATERIALS AND FABRICATION

A. General Ductwork Fabrication Requirements

1. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's 2005 "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals

    a. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification
    b. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations

2. Provide fittings, branches, inlets and outlets in such a manner that air turbulence is reduced to a minimum.

3. Turns

   a. Use radius type elbows wherever possible. Where it is not possible to install a 1.5 times width to centerline radius elbow (full radius elbow), use lesser radii configurations, with 'radius-proportional' splitter vanes permanently installed within. No radius shall be less than 1.0 times width. Provide square elbows of equivalent pressure drop in rectangular ducts where radius elbows will not fit or where specifically noted on drawings. Elbows shall be installed with turning vanes in accordance with Related Section "HVAC Duct Accessories." Stamped elbows may be used up to and including a diameter of 12 in.

4. Transitions

   a. Limit transition angles (for each side) to 15 degrees diverging and 30 degrees converging.

5. Take-Off Fittings

   a. For take-offs carrying more than 25 percent of duct main, provide an increasing branch elbow with an inside radius equal to branch duct width. Size branch and main at elbow for equal velocity.
   b. For take-offs carrying 25 percent or less of duct main, provide flanged increased area branch take-off (45 degree entry, "shoe" type) or 45 degree lateral wye takeoffs. Conical fittings shall be used for spiral, round, and oval ductwork.
   c. For take-offs directly to side outlet for register or grille, provide an increased area tap. For take-offs directly to diffusers see appropriate SMACNA figures.
   d. Acceptable take-off fitting manufacturers: Sheet Metal Connectors, Inc.; United Sheet Metal; McGill Airflow LLC; Foremost; Tangent; Flexmaster; SEMCO Inc.

6. Crossbreak or bead rectangular ductwork.
7. Rectangular duct longitudinal seams shall be Pittsburgh lock 3/8 in. minimum pocket.
8. Bolts and Fasteners

   a. Carbon steel, zinc coated per ASTM A153 for G-90 and stainless steel for aluminum and stainless steel ducts.

9. Welding Materials

   a. Refer to SMACNA "Guidelines for Welding Sheet Metal" for applicable requirements.

B. Galvanized Steel Ductwork

1. Minimum steel rectangular duct gage shall be as follows:

   a. Ducts through 12 in. wide: 24 Gage
   b. Ducts 13 in. through 30 in. wide: 22 Gage.
   c. Ducts 31 in. through 84 in. wide: 20 Gage.
   d. Ducts 84 in. and larger: 18 Gage

2. Lock-forming quality ASTM A653, A924 mill galvanized steel sheet, 1.25 oz per sq. ft. zinc coating on each side in conformance with coating designation G-90. Mill-phosphatized finish for surfaces of ducts exposed to view.

C. Galvanized Touch-Up Paint: Inorganic zinc-rich touch up paint containing a minimum of 65 percent metallic zinc by weight for damaged galvanized coating.

1. Acceptable manufacturers/product: Carboline/Carbo-Zinc, Tnemec/Tneme-Zinc

D. Round and Flat Oval Ductwork

1. All round and oval duct shall be manufactured of spiral lock seams, with minimum gage per the appropriate SMACNA Tables and per manufacturers recommendations. Ductwork up to 12 in. diameter and 2 in. w.g. can be manufactured with longitudinal lock seams.
2. Tees shall be conical. Laterals shall be straight. Taps through 10 in. diameter in size shall have a machine drawn entrance and fittings shall have longitudinal seams, continuously welded. Both sides of welds shall be primed with zinc chromate. Tap entrances shall be free of weld build-up.
3. Elbows in diameters 2 in. through 10 in. shall be stamped or pleated. Elbows shall be 5 gore for 90 degrees and 3 gore for 45 degrees. Elbows shall have 1.5 times width to centerline radius (full radius elbow).
4. Flanges, access doors and taps into spiral ducts shall be factory fabricated.
5. Field joints in diameters through 48 in. shall be made with 2 in. long slip-fit, sleeve coupling, or flanges. Ductwork 48 in. diameter and over, and for all sizes where disassembly or removal is required, shall be joined with flanges.

E. Reinforcing and Supports

1. Structural steel per ASTM A36; Mill galvanized per ASTM A653, Coating Designation G-90. Equivalent rolled steel structural support systems (such as TDF or TDC) may be used in lieu of mill rolled structural steel. Use double nuts and lock washers on threaded rod supports.
2. Tie-Rods

    a. Maximum tie rod spacing shall be 42 in., unless specifically engineered in accordance with SMACNA Industrial Rectangular Duct Standard.
    b. Minimum tie rod diameter shall be 1/2 in.
    c. Tie Rods shall not be used in any plenum or ducts that require access.
    d. Tie rods shall not be used in any PCD, cage wash, stainless steel, or ducts carrying lint.
    e. Tie rods shall not be used in any return or exhaust ducts in health care facilities.

2.3 FLEXIBLE DUCT

A. General

1. Flexible duct shall be UL listed, and shall maintain shape when installed. Sagging shall not exceed 1/2 in. per linear foot when installed horizontally.
2. Flexible duct shall not be used where system pressure is greater than plus or minus 2 in. w.g.
3. Insulated flex shall have a gray fire retardant polyethylene outer jacket with an 8 oz. density, 1-1/3 in. thick fiberglass insulation blanket, factory wrapped.
4. Flexible duct used on negative pressure systems shall be specifically rated for negative pressure use.
5. For connection to supply, return and exhaust diffusers/grilles located in horizontal ceilings, use pre-fabricated 90 degree plastic supports (Flexflow Elbow by Thermaflex), or 90 degree sheet metal elbow fittings.

B. Flexible Nonmetallic Duct

1. Flexible nonmetallic duct shall be constructed of sound transparent foil. Material shall be mechanically locked to the outside helix. Use of adhesives to lock fabric in place is not acceptable. The helix shall be constructed of corrosion resistant galvanized steel, formed and mechanically locked to the duct fabric on the outside to prevent tearing.
2. Flexible fabric duct shall be rated at 6 in. positive pressure and at 4 in. negative pressure.
3. Flexible nonmetallic duct shall be listed UL Class 1.
4. Acceptable Manufacturers

    a. Flexmaster
    b. Hart & Cooley.
    c. Atco

2.4 SPECIAL DUCTWORK CONSTRUCTION

A. Ductwork required to be removable shall utilize companion flanges.

2.5 DOUBLE-WALLED PANELS, PLENUMS AND DUCT AT OUTSIDE AIR INTAKE PLENUMS

A. Double-walled type panels, 2-1/2-in.-thick, constructed from smooth or embossed mill finish G-90 galvanized steel facing sheets. Each panel shall contain an integral frame of G-90 galvanized steel or extruded aluminum bonded to the facing sheets to provide a moisture-tight seal at the panel perimeter. Panels shall be load bearing and capable of forming the plenum or duct without the installation of structural members. Join panels together with G-90 galvanized steel or extruded aluminum mullions and fasten with closed end rivets. Make connections to the duct or plenum using a support mullion that is an integral part of the panel and not bolted to or through the panel. Gasket all joining mullions with a double vinyl gasket or a double butyl gasket to provide a permanent air-tight seal. Design panel skins, core density, rib spacing, and mullion spacing to eliminate panel pulsation and to a maximum deflection of 1/200 of any span at design pressure, positive or negative. The overall “U” factor of the panels shall not exceed 0.14 BTU/ft²/°F.

B. Removable panels shall be the same construction as described above, with double seals around periphery to guarantee tight closure.

C. Access doors shall be constructed as follows.

1. Doors shall be minimum 24 in. wide whenever possible, or widths as indicated on drawings. Provide doors that are the full height of the panel, maximum 5 ft. high.
2. Each access door shall be equipped with continuous double gaskets and shall fit in the door frame in a manner to guarantee tight closure.
3. Hinges and hardware shall be galvanized, stainless steel or aluminum. Outdoor unit hardware shall be stainless steel, or aluminum. Provide at least 2 handles per door, operable from either side.
4. Access doors in positive pressure sections shall open inward, in negative pressure sections shall open outward.
5. Where indicated, provide a glass window in the access door, minimum 6 in. by 6 in. size, located at a height convenient for viewing, sealed to prevent leakage, rated to operate safely against the duct/plenum pressure rating. Provide double pane insulating type glass at all locations connected to outdoors/exterior or exposed to air temperatures below 55F; single pane at other locations.

D. The manufacturer shall have published literature available stating the coefficient of absorption and the sound transmission loss characteristics of the panels system per ASTM C 423 and the sound transmission loss properties per ASTM E 90 and E 413. Published acoustic data shall show the trademark or name of the manufacturer, shall have been verified by a recognized independent testing laboratory, and shall specify the coefficient of acoustic absorption and attenuation by octave band. Submit acoustic performance data in graphic and tabular form as part of the shop drawings. Minimum panel performance for 2-1/2 inch thick panels shall be as follows:

Frequency	125	250	500	1000	2000	4000
Transmission Loss (dB)	14	22	28	35	43	48
Absorption Coefficient	0.3	0.7	0.95	0.95	0.95	0.85

E. The duct and plenum systems, in addition to supporting indicated equipment, scheduled maximum operating pressure, and system test pressure, shall sustain a 35 lb. per sq. foot maintenance function load without permanent deformation or damage.

F. Acceptable Manufactures.

1. McGill Airflow LLC.
2. SEMCO Mfg Co.
3. Vibro-Acoustics

2.6 BLANK-OFF PANELS FOR UNUSED LOUVER AREAS

A. Provide a minimum 20 gage, G-90 galvanized or aluminum, insulated sheet metal blank-off panels for unused louver sections. Panels may be of the double-walled or single wall insulated type. For double-walled type panels, the insulation shall have an overall “U” factor of 0.14 BTU/ft²/°F. Insulation for single skin panels shall be of the rigid type and of the thickness as specified for outside air intake ducts located in mechanical rooms in Related Section "Mechanical Systems Insulation," permanently secured to the panel skins. Panels shall have a maximum deflection of 1/200 of any span at wind velocities of up to 100 MPH.

B. Exterior/visible face of blank-off panel shall be cleaned and painted flat black, prior to installation.

2.7 BELLMOUTH CONNECTIONS

A. Bellmouth fittings shall be constructed to match material requirements as indicated on drawings.

B. Bellmouth shall have a minimum radius of 1 1/2 in. with 1/2 in. flange and 1/2 in. by 1/8 in. thick neoprene gasket.

C. Acceptable Manufactures.

1. Buckley Associates
2. McGill Airflow LLC
3. SEMCO Mfg Co.

2.8 DUCT LINER

A. General: Comply with NFPA 90A or NFPA 90B and NAIMA's "Fibrous Glass Duct Liner Standard."

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Certain Teed “ToughGuard™ R” with “Enhanced Surface”.
2. Owens Corning “QuietR Textile Duct Liner”.
3. Knauf “Sonic XP Duct Liner”.

C. Materials: Fiber Glass Duct Liner with a factory-applied coated surface exposed to airstream to prevent erosion of glass fibers and a transverse edge coating per SMACNA and NAIMA.

1. Thickness: 1 inch (unless otherwise noted).
2. Model Building Code: ICC
3. Material Standard: ASTM C1071, Type, CAN/CGSB-51.11-92.
4. “GREENGUARD”: Children & Schools.
5. Fire-Hazard Classification: Maximum flame-spread rating of 25 and smoke-developed rating of 50, when tested according to UL 723, ASTM E84, NFPA 255.
6. Limited Combustible: <3500 btu/lb per NFPA 259.
7. Thermal Conductivity (k-Value): 0.24 at 75 deg F mean temperature as tested in accordance with ASTM C518 and/or ASTM C177.
8. Acoustical Performance: 0.70 NRC as tested in accordance with ASTM C423 using Type A mounting per ASTM E795.
9. Maximum operating temperature: 250F per ASTM C411.
10. Maximum operating velocities: 6000 fpm per ASTM C1071. Above duct velocities of 5500 fpm install perforated inner metal liner over the duct liner.
11. Water Vapor Sorption: < 3% by weight per ASTM C665.
12. Corrosiveness: Pass per ASTM C665.
13. Bacteria Resistance: No Growth per ASTM G22.
14. Fungi Resistance: Pass; No Growth per ASTM C1338 and ASTM G21.
15. Water Repellency Rating: > 4 per INDA IST 80.6-92.
16. LEED™: Minimum 25% recycled content based on LEED™ definition.
17. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and ASTM C 916.

18. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

    a. Tensile Strength: Indefinitely sustain a 50 lb. tensile, dead-load test perpendicular to duct wall.
    b. Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.

19. Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.
20. Ductwork Requiring Lining:

    a. First 15’ of ductwork upstream of exhaust fans.
    b. First 10’ of terminal units.
    c. All transfer ducts.

2.9 DUCT SEALANTS

A. Solvent-based sealants may only be used if the outdoor air temperature will be below 40˚F within 24 hours of applying.

B. Sealant shall be non-asbestos type, and comply with UL and NFPA 90A.

C. Sealant: Water or solvent based elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) specifically for sealing ductwork. Use products as recommended by manufacturer for low, medium or high-pressure systems

1. Acceptable Manufacturers.

    a. Hardcast
    b. McGill Airflow LLC
    c. Polymer Adhesives
    d. Ductmate

D. Tape shall not be used.

E. Gaskets and mastics used for flanged joints shall be compatible for the service of use and per the manufacturer’s recommendations.

PART 3 - EXECUTION

3.1 GENERAL SHEET METAL DUCTWORK INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Ductwork shall be installed to true alignment, parallel or perpendicular to adjacent building walls, floors and ceilings, to present a neat and quality workmanlike appearance.

D. Provide necessary offsets and transitions to avoid interference with the building construction, piping, or equipment. Locate ducts with sufficient space around equipment to allow operating and maintenance activities.

E. Bullhead tees and straight tap connections are not acceptable.

F. Provide straight runs of ductwork, upstream and downstream, at equipment, fans, coils, air terminal units, humidifiers and the like per manufacturer's recommendations and as indicated on drawings.

G. Provide flexible connector where ductwork connects to fans, air handling units (unless internally isolated), other rotating equipment, and where indicated on drawings.

H. Repair damaged galvanized surfaces with zinc rich paint.

I. For ductwork mounted outdoors, install duct with slight lateral pitch to prevent water ponding on top of duct.

J. Enclose dampers located behind architectural intake or exhaust louvers in a sheet metal collar and seal to building construction.

K. Air volume control on parallel flow branches shall be accomplished with branch dampers. Splitter type dampers are not acceptable.

L. Install special equipment items in ductwork systems including, but not limited to: control dampers, thermometers, airflow measuring devices and other related items, according to manufacturer's recommendations.

M. Set plenum doors 6 in. to 12 in. above floor. Arrange door swings so that fan static pressure holds door in closed position.

N. Store duct at least 4 in. above floor on wood pallets or similar devices. Protect duct from odors, dust, moisture, and other debris while stored on or off the jobsite, and when transporting to the jobsite, by tightly covering with plastic.

O. Ductwork openings shall remain protected and covered until just prior to connection. Immediately after assembly, restore all protection to prevent odors, dust, moisture, and other debris from entering ductwork system. Remove any internal labels.

P. Provide required penetrations and sleeves in building structure.

Q. Blank-off panels shall be screwed to louver blades and caulked to provide a weather tight seal.

3.2 FLEXIBLE DUCTWORK INSTALLATION

A. Flexible duct runs shall not exceed 5 ft. long. Cut to length so that it is not compressed. Trim ends squarely. Sag shall not exceed 1/2 in. per linear foot when installed horizontally.

B. Provide a minimum of 3 ft. of flexible non-metallic duct at connections to supply, return and exhaust diffusers/grilles mounted in horizontal ceilings, unless otherwise noted.

C. Support at a maximum spacing of 2 ft. using 4 in. wide sheet metal protection saddles at each duct hanger. Flex duct directional changes shall not exceed 45 deg with centerline radius of bend no less than one-half times duct diameter.

D. For connection to supply, return and exhaust diffusers/grilles located in horizontal ceilings, use pre-fabricated 90 degree plastic supports (such as the Flexflow Elbow by Thermaflex), or 90 degree sheet metal elbow fittings.

E. Apply duct sealant to outside surface of collars and secure with metallic draw-band where flexible duct joins other duct or devices.

F. Flexible duct shall not be used to connect terminal units to branch or main ducts.

3.3 SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS

A. All duct liner shall be installed in accordance with the requirements of the NAIMA Fibrous Glass Duct Liner Standard or SMACNA HVAC Duct Construction Standard and the herein requirements.

B. Duct liner shall be kept clean and dry during shipping, storage, job site installation, commissioning and system operation. All lined ductwork shall be protected from any moisture using secured plastic and stored on wood palates until installed. During installation, protect open ended ducts with plastic.

C. The liner shall be cut and fitted to ensure all joints are neatly and tightly butted with no interruptions or gaps. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

D. Provide a perforated inner metal liner over the duct liner in any system with high in duct velocities exceeding 5500 fpm.

E. Do not apply liners in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. All duct liner products shall be adhered to the sheet metal ductwork using an adhesive meeting the requirements of ASTM C916.

G. Adhere a single layer (multiple layers of duct liner to achieve indicated thickness are prohibited) of indicated thickness of duct liner with a minimum of 90 percent coverage of adhesive on the metal surfaces. Apply adhesive to duct liner facing in direction of airflow not receiving metal nosing. Mechanical fasteners of the specified type and length shall be used, ensuring no greater than 10% compression of the liner thickness.

H. In Addition to applying adhesive, secure duct liner to the sheet metal ductwork using weld secured mechanical fasteners. Butt transverse joints without gaps and coat joint with adhesive. Secure liner per SMACNA Standards with welded mechanical fasteners, 4 inches from corners and at intervals not exceeding 12 inches transversely around perimeter; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

I. Butter all raw edges to coat duct cut-ins and/or minor installation damage.

J. Secure transversely oriented liner edges facing the airstream with metal nosing that have either channel or "Z" profile or are integrally formed from duct wall. Fabricate edge facings at the following locations:

K. Fan discharge.

L. Intervals of lined duct preceding unlined duct.

M. Upstream edges of transverse joints in ducts.

3.4 DUCTWORK HANGERS AND SUPPORTS

A. Generally, hang and support ductwork per the latest edition of SMACNA. Additionally, adhere to the more specific requirements found in this specification section and as indicated on the Project drawings.

B. Hanging duct, equipment, or accessories with cables or wires is prohibited.

C. Comply with Project drawing details regarding hangers, building attachments, fasteners, beam clamps and retaining clips, and as noted below.

D. Provide vibration isolation as specified in the related Specification Section.

E. Ductwork shall be supported and anchored to structure so that horizontal ducts are without sag or sway, vertical ducts without buckle, and so that all ducts are free from deformation, collapse or vibration.

F. Support un-insulated rectangular ducts in sizes to 36 in. by non-perforated galvanized steel strap or by trapeze hangers. Support insulated rectangular ducts and ducts larger than 36 in. with trapeze hangers.

G. Provide at least one support for each length of duct, with a maximum hanger spacing of 10 feet. Install supports on both ends of duct turns, branch fittings and transitions.

H. Do not hang ductwork from piping, ducts, other trades' hangers, existing hangers, or equipment.

I. Single band hangers are not acceptable on ducts greater than 24 in. diameter.

J. Provide supports on each side of any duct mounted equipment or device, including fans, coils, dampers, etc, to permit removal of item without removal of adjacent duct sections.

K. Provide supplemental steel required to support ductwork in shafts, mechanical rooms or on the floor where structural steel is not properly positioned.

L. Beam clamps shall be double sided on ducts over 36 in. by 36 in. Use double sided or single sided beam clamps with retaining clips on all other sizes.

M. Do not modify existing structural steel without approval of Project Manager and a structural engineer's review.

N. Provide clamping systems that are compatible with the structural steel system of the building.

O. Use angle iron "V" construction supports or similarly rigid construction for vertical ducting that requires lateral support.

P. Ductwork mounted on roof or otherwise exposed to elements shall be supported with frames constructed of galvanized steel angles and channels, regardless of duct size. Supports shall not rest on top of roof, but shall be firmly attached to roof structure and properly flashed. Ducts that penetrate through the roof shall utilize curbs and shall be counter-flashed. All fasteners shall be galvanized.

Q. Provide angle sway bracing and diagonal cross bracing to the structure to provide support against maximum lateral loads that may be imposed on the ductwork installed downstream of fan discharges and ductwork exposed to wind loads, and any other locations exposed to lateral loads.

R. All materials used for support in pool and pool mechanical areas shall be fabricated from stainless steel and/or aluminum.

3.5 DUCTWORK PAINTING

A. Where the interior of duct is visible through grilles, registers, diffusers or other air diffusion devices, paint the interior flat black. Coordinate work with Architectural Trade.

B. For plenum returns, where equipment and structure above ceiling is visible through return air grilles, provide black sheet metal baffle with turned edges suspended from building construction. Size and position the baffle to prevent restriction of air flow. Where space above ceiling precludes use of a baffle, paint visible building surfaces flat black.

3.6 TEMPORARY USE

A. Develop a plan that assures ductwork is protected during temporary use. Obtain approval of the plan from the Owner's Representative.

B. Maintain the protection plan until just prior to Owner turn-over.

C. Successfully complete return/negative pressure duct leak testing prior to duct temporary use.

D. Temporary filters shall be provided in return or negative pressure duct to protect ductwork and building contents when any fans are operated during construction. Filters shall have an equal or better performance rating than the air handling unit pre-filters specified for permanent use, but not less than MERV 8, in order to prevent construction dirt infiltration into duct systems. Install filters over grilles, diffusers, and all duct openings. Provide filters over supply grilles, diffusers and duct openings if construction dust and debris will enter when operated for temporary service (e.g. air system cycles off during periods when construction continues). Seal around temporary filters to prevent filter bypass.

E. Continuously maintain all filters and replace when pressure drop exceeds 1 in. w.c., or at manufacturer's recommended change-out pressure drop, whichever is lower.

F. Remove temporary filters and associated materials, and clean any adhesive residue from finished surfaces, at completion of temporary use.

3.7 DUCTWORK SEALING, INSPECTION AND LEAKAGE TESTING

A. Seal, inspect and test prior to insulating or concealing ductwork.

B. Seal all ductwork, regardless of pressure class, to SMACNA Seal Class A (Seal all transverse joints, longitudinal seams, and duct wall penetrations):

1. Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage.
2. Pressure sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory and the tape is used in accordance with that certification.
3. All connections shall be sealed, including but not limited to spin-ins, taps, other branch connections, access doors, access panels, and duct connections to equipment.
4. Spiral lock seams do not require sealing.

C. Perform measured leak testing on the following ductwork:

1. 100% of ductwork that is intended to operate in excess of 3 inches water column
2. 100% of ductwork located outdoors
3. Representative sections totaling no less than 25% of the total installed duct area for each designated pressure class of 3 inches water column and below.
4. 100% of welded ductwork
5. Maximum permissible leakage rate (Lmax in cfm/100 ft2 of duct surface area):

    a. Lmax = 4 x P^0.65, where P = test pressure which shall be equal to the design duct pressure class rating in inches water column.
    b. Welded Ductwork: Zero leakage.

D. Ductwork Leakage Testing Procedures:

1. Prior to fabrication and installation, develop and submit for approval a ductwork testing plan, indicating locations of temporary caps, surface area of ductwork test sections, test pressure, leakage class and allowable leakage in cubic feet per minute.
2. Notify the Owner's Representative at least 2 days prior to each test.
3. Provide all blank-off plates, flanges, and safing required to isolate each section of duct to be tested.

4. Provide necessary testing apparatus.
5. For all ducts, pressurize ductwork to the specified pressure class and inspect ductwork for visual and audible leaks, and leaks perceptible to a hand 2 in. from duct. Reseal all perceptible leaks until acceptable to Owner's Representative.
6. After completing visual and audible inspection, conduct measured ductwork leakage tests at the specified pressure class for the duct. Reseal and retest as required until successfully achieving the specified leakage class.
7. Positive pressure leakage testing is acceptable for negative pressure ductwork.
8. Submit leakage test report for approval, using SMACNA or other approved form.

END OF SECTION 23 3100

SECTION 23 3300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers
2. Manual-volume dampers
3. Turning vanes
4. Duct-mounted access doors and panels
5. Flexible ducts
6. Flexible connectors
7. Duct accessory hardware

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers
2. Manual-volume dampers
3. Fire and smoke dampers
4. Duct silencers
5. Duct-mounted access doors and panels
6. Flexible ducts

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:

1. Special fittings and manual and automatic volume damper installations.
2. Fire and smoke damper installations, including sleeves and duct-mounted access doors and panels.

C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA standards:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.

C. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish for ducts exposed to view and mill finish for concealed ducts.

D. Extruded Aluminum: ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4 inch minimum diameter for 36 inch length or less; 3/8 inch minimum diameter for lengths longer than 36 inches.

2.2 MANUAL-VOLUME DAMPERS

A. General: 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 Classifications 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.

B. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

C. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

D. Jackshaft: 1 inch diameter, galvanized steel pipe rotating within a 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 of a multiple-damper assembly.

E. 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.

2.3 TURNING VANES

A. Fabricate to comply with SMACNA's 2005 "HVAC Duct Construction Standards--Metal and Flexible."

B. Manufactured Turning Vanes: Turning vanes shall be double wall turning vanes fabricated from the same material s the duct. Fabricate of 1-1/2 inch wide, curved blades set 3/4 inch on center; support with bars perpendicular to blades set 2 inches on center; and set into side strips suitable for mounting in ducts.

1. Turning vane front and back panels shall be securely locked together with adequate crimping to prevent twisting of vane. Vane shall be capable of withstanding 250 pounds of tensile load when secured according to the manufacturer’s instructions.
2. Rails for mounting turning vanes shall have self-locking, friction fit tabs designed to facilitate proper alignment of vanes. Tab spacing shall be as specified in Figure 4-3 of the 2005 SMACNA Manual, “HVAC Duct Construction Standards, Metal & Flexible” Third Edition standard. Rail systems with non-compliant spacing shall not be accepted.

C. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill. Mounting rails shall have friction insert tabs that align the vanes automatically.

2.4 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. General: Fabricate doors and panels airtight and suitable for duct pressure class. Provide access doors of adequate size to allow easy access to the equipment that will require maintenance. Provide insulated or acoustically lined doors to prevent condensation where applicable.

B. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.

C. Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1 inch butt or piano hinge and cam latches.

D. Seal around frame attachment to duct and door to frame with neoprene gasket.

E. Insulation: 1 inch thick insulation that does not contain phenol, formaldehyde, acrylics or artificial colors. Certified to GREENGUARD for the industry's most stringent IAQ standard, children in schools.

2.5 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4 inch wide, 0.028 inch thick, galvanized, sheet steel or 0.032 inch aluminum sheets. Select metal compatible with connected ducts.

C. Transverse Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 4-3/8 inch wide, 0.028 inch thick, galvanized, sheet steel or 0.032 inch aluminum sheets. Select metal compatible with connected ducts.

D. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.

E. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.

2.6 FLEXIBLE DUCTS

A. General: Comply with UL 181, Class 1.

B. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2 inch thick, glass-fiber insulation around a continuous inner liner.

1. Reinforcement: Steel-wire helix encapsulated in inner liner.
2. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
3. Outer Jacket: Polyethylene film.
4. Inner Liner: Polyethylene film.

C. Pressure Rating: 6 inch wg positive, 1/2 inch wg negative.

2.7 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 length to suit duct insulation thickness.

B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4 inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.

D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.8 GRAVITY INTAKE/RELIEF HOODS

A. Manufacturers:

1. Acme Engineering and Manufacturing Corporation
2. Aerovent; a Twin City Fan Company
3. Carnes
4. Greenheck
5. Loren Cook Company
6. Penn Ventilation

B. Factory or shop fabricate according to SMACNA’s “HVAC Duct Construction Standards - Metal and Flexible,” Figures 5-6 and 5-7.

C. Materials: Aluminium sheet, minimum 0.063-inch-thick base and 0.050-inch-thick hood; suitably reinforced.

D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inth-thick, rigid fiberglassw insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Built-in raised cant and mounting flange.
2. Overall Height: 18 inches.

E. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.

B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

C. Provide test holes at fan inlet and outlet and elsewhere as indicated.

D. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.

1. Install fusible links in fire dampers.

E. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.

1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
2. Install access panels on side of duct where adequate clearance is available.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

END OF SECTION 23 3300

SECTION 23 3400 - FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Centrifugal Fans:

    a. Domed roof

1.3 SUBMITTALS

A. Submit the following product data for each unit:

1. Static pressure, airflow (CFM), speed (RPM), system curve, outlet velocity and fan tag for each fan.
2. Certified fan curves showing fan performance with the system operating points identified on curves. Surge, or "Do not operate" line, shall also be indicated on fan curve.
3. Performance curves shall be published by the fan manufacturer and based on tests in accordance with AMCA 210. The curves shall be drawn with the fan flow rate plotted against fan total pressure and fan brake horsepower as per section 10.2.1 of AMCA 210.
4. Bearing sizing and life calculations for each similar size and type of fan. Fan bearing calculations shall be based on fan maximum operating conditions including belt pull. Calculations shall be provided for both fan bearings and motor bearings.
5. Sound power levels for each size and type of fan. Sound levels shall be provided for all 8 octave bands for discharge of fan, inlet to fan, and radiated noise through casing.
6. Dimensional data for each size and type of fan, including operating and maintenance clearances.
7. Details of vibration isolation bases including selections for vibration isolation springs.
8. Details of fan discharge flexible duct connector.
9. Details of motor and belt guards.
10. Motor ratings, electrical characteristics, and motor accessories.
11. Fan anti-corrosion coating data sheets.

1.4 QUALITY ASSURANCE

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the following quality assurance standards; latest editions, unless noted otherwise.

1. ANSI/AMCA Standard 99-2404, "Drive Arrangements for Centrifugal Fans."
2. ANSI/AMCA Standard 99-2406, "Designation for Rotation and Discharge of Centrifugal Fans."
3. AMCA Standard 99-2408, "Operating Limits for Centrifugal Fans."
4. ANSI/AMCA Standard 260 "Laboratory Methods of Testing Induced Flow Fans for Rating."
5. ANSI/AMCA Standard 300, "Reverberant Room Method for Sound Testing of Fans."
6. ANSI/AMCA Standard 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data."
7. ANSI/AMCA Standard 204, "Balance Quality and Vibration Levels for Fans."
8. UL-705, "Power Ventilators" (applies only for fans exposed to outdoor conditions).
9. UL-762, "Power Roof Ventilators for Restaurant Exhaust Appliances."

10. UL-793, "Standard for Automatically Operated Roof Vents for Smoke and Heat."
11. American Bearing Manufacturers Association (ABMA) Standards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Fan manufacturer shall provide protection to insure that the interior and exterior of each fan is completely protected from dirt or weather during shipping. Openings shall be covered with sealed sheet metal, plastic or other durable means to ensure unit cleanliness is maintained.

1.6 WARRANTY

A. Provide a complete parts and labor warranty for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. All fan types specified in this Section:

a. Loren Cook Company
b. Greenheck

2.2 GENERAL CONSTRUCTION - ALL FANS

A. Provide balanced variable sheaves for motors 7.5 HP and under and fixed sheaves for motors 10 HP and over. Size variable sheaves at midpoint of specified operating conditions to allow field adjustment up or down during balancing procedures. Where fixed speed sheaves are specified for a specific fan, provide one (1) additional sheave set, if required, for final balancing.

B. Fan selection and ratings shall be based on tests made in accordance with AMCA 210.

C. Fans shall be AMCA licensed and shall bear the AMCA seal for both sound and performance levels.

D. Fan shall be minimum Class I construction with proper UL label.

E. The specified fan RPM, outlet velocity, and tip speed are the maximum acceptable. The motor horsepower, CFM, and static pressure are the minimum acceptable.

F. Unless noted otherwise by specific fan type or per schedule, fan housing shall be heavy gauge continuous welded corrosion resistant steel construction with fan scroll and bearings supported from structural steel framework.

G. All fasteners shall be corrosion resistant type.

H. Fan housing shall be of suitable thickness and bracing required for stable and rigid construction, with no deflection, and to prevent vibration and pulsation.

I. Fans having duct-connected inlets shall be provided with a flanged inlet and/or outlet collar matching companion flange.

J. Provide OSHA belt guards on all belt driven fans.

K. For exterior mounted fans, a weatherproof housing shall be provided with ventilation grilles to cover motor and drive assembly.

L. Provide special construction fans, such as spark-proof, explosion-proof, or specially coated fans as required by schedules or as specified herein.

M. Provide birdscreen on fans exposed to the exterior environment.

N. Provide adequate space for service of fan, motor and bearings.

O. The fan shaft shall be solid high carbon steel, accurately turned, ground and polished, and ring gauged for accuracy.

P. Recommended bearing manufacturer tolerances shall be met in the area of the shaft in contact with the bearings.

Q. Shafts must be dial indicator inspected for straightness after the keys are cut.

R. Fan shaft shall be coated with rust inhibitive coating.

S. Fan wheel assembly or propeller assembly shall be statically and dynamically balanced prior to fan assembly.

T. The entire rotating assembly shall be designed so the first critical speed is at least 25% over the maximum fan class speed.

U. Fan Shaft Bearings:

1. Fan bearings shall be bolted on a rigid welded steel framework integral with the housing.
2. Bearings shall be designed and individually tested specifically for use in air handling applications.
3. Bearings shall be sized for a minimum L-10 life of 200,000 hours at the maximum fan class operating speed and horse power. Selection shall account for all operating conditions including belt pull. Bearings shall be selected in accordance with standards set forth by the American Bearing Manufacturers Association (ABMA).
4. Bearings shall be grease lubricated self-aligning ball or roller type. Provide tapered roller bearings for vertical applications.
5. Bearing housings shall be solid cast iron, pillow block or flange mount type. Provide split pillow block bearings where required by the application speed.
6. Stamped bearing housings are permitted on fans of 1/4 HP or less.
7. Bearings shall be of the type that can be re-lubricated, and shall be equipped with grease fittings.

V. Where fan bearings are not easily accessible or are installed in a hazardous exhaust airstream, provide clear plastic grease leads, properly secured to avoid damage or fatigue, routed to an accessible location.

W. Fan Drive:

1. Fan drive shall be a multiple V-belt type sized for 1.65 times the fan motor horsepower. Sheaves shall be fixed or adjustable based on fan motor horsepower as specified herein before. Fan sheave shall have a tapered lock, split and keyed hub. Grove spacing on equipment and motor pulleys shall align. For fans 1/2 HP and larger, quantity of belts shall be such that if any one belt fails, remaining belts shall allow fan to continue functioning as designed. Multiple belts shall be provided as a matched set.
2. Motors shall meet requirements as specified in Motors section.
3. Motor shall be 1800 rpm maximum for belt driven or direct drive fans.
4. On OSHA approved type fan drive guard shall be provided with provision for RPM measurement at both motor and fan without removing the guard. The guard shall be made of 1/2 in., 16 gauge flattened expanded steel, wrapped around a 16 gauge channel frame suitably braced to prevent vibration. Guard shall be G-90 galvanized, or painted to match fan housing paint.
5. Fan belts shall be oil resistant 24,000-hour non-static belts.

X. Provide thrust arrestors as required to limit movement of the fan upon start-up.

Y. Provide riveted, engraved aluminum nameplate containing pertinent, specific fan data, including manufacturer, model, serial number, and electrical data, etc.

2.3 CENTRIFUGAL FANS

A. General:

1. Centrifugal type fans shall be belt drive, unless noted otherwise
2. Fans shall be backwardly inclined, airfoil, or flat blade type with a minimum of 9 blades.
3. Fans shall have sharply rising pressure characteristics at the operating point specified and shall be quiet and stable in operation. Horsepower characteristics shall be self-limiting (non-overloading) and at peak value at the specified operating point.
4. Each fan base shall be fully assembled with motor and drive on a structural steel base.

B. Fan Housing:

1. Fans having wheel diameters 36 in. and larger shall have horizontally flanged split housings as required for installation.
2. Fan housing and inlet shall be constructed to allow the fan wheel(s) to be removed through the inlet opening when the inlet cone is removed.
3. Provide a quick opening inspection door with heavy duty latches.
4. A 1/2 in. NPT tapped 3/4 in. diameter pipe coupling drain connection shall be welded to the fan scroll at the lowest point, equipped with a pipe plug.
5. Class I and II fans shall be convertible to a minimum of 8 standard discharge arrangements.
6. Provide a Fan cut-off to deliver good pressure distribution.

C. Fan Inlet and Wheel Cone:

1. Provide a precision die-spun or formed, and matched inlet and wheel cones for streamlined airflow into the wheel to ensure full loading of the blades.
2. Inlet and wheel cones shall be hyperbolic. Radial side sheets are not acceptable.
3. Inlet cone shall be heavy gauge, bolted to fan housing to allow for removal.
4. Fans that are not duct-connected shall be provided with inlet/outlet screen(s). Screen(s) shall be standard manufacturer provided screen or galvanized maximum nominal 1 in. by 1 in. mesh fabricated 10 gauge steel.
5. Hubs shall be straight bored or use taper lock bushings, keyed and set screwed to shaft for positive attachment. Hubs shall be securely riveted or bolted to the backplate or center plate. Bushed hubs are not acceptable.
6. Double-width double-inlet fans shall be a single wheel of the common center plate design or 2 single-width single-inlet wheels back-to-back, each keyed and set screwed to a common shaft.
7. Fan blades shall be continuously welded to the inlet hub and the backplate.
8. Wheel center plate or backplate shall be heavy gauge steel construction with a minimum gauge as indicated in material construction schedule.

D. Domed Roof:

1. General:

a. Housing shall be constructed of heavy gauge spun aluminum with a rigid internal support structure.
b. Fan wheel shall be backward inclined.
c. Drive frame assembly shall be constructed of heavy gauge steel.
d. Motors and drives shall be mounted on vibration isolators, out of the air stream.
e. Fresh air for motor cooling shall be drawn into the motor through a tube free or contaminants or through a space between the fan shroud and the motor cover.
f. Fan drives shall be sized for 1.5 times the motor horsepower. Pulleys shall be cast type, keyed and securely attached to the wheel and motor shafts.
g. Motor pulleys shall be adjustable for final balancing.

h. Provide a factory-installed disconnect switch, wired from the fan motor to a junction box installed within the motor compartment. Provide a conduit chase through the base to the motor compartment.
i. When backdraft dampers are installed below fan, provide a heavy gauge hinge kit to allow entire fan to tilt away from roof curb for access to dampers. Construct hinge kit with aluminum hinges and hold open cables for field installation.

2. Roof-mounted up blast exhaust fans shall have a leak proof housing constructed with a one-piece windband with an integral rolled bead, and shall be joined to the curb-cap with a continuously welded seam.
3. Sidewall mounted exhaust fans shall have a leak proof housing constructed with a one-piece windband with an integral rolled bead. Provide a mounting plate that will be attached and sealed to the wall prior to installing fan.

2.4 SOURCE QUALITY CONTROL

A. Run test all fans 1 HP and larger at the factory before shipment. Testing shall be conducted at the maximum fan class speed.

B. Statically and dynamically balance each fan per AMCA procedures. Perform electronic vibration analysis at the maximum fan class speed for all fans over 5 HP.

C. Unless noted otherwise, the installed maximum allowable RMS velocity at maximum fan class speed measured at each bearing shall not exceed 0.09 inches/sec in vertical, horizontal, and axial directions.

D. Fans may be field tested after installation by an independent third party. Any fan found to exceed specified vibration limits shall be corrected to perform within those limits without cost to the Owner.

PART 3 - INSTALLATION

3.1 FAN INSTALLATION

A. Coordinate the fan arrangement with project conditions prior to ordering the fan.

B. Receive and inspect fans for defects. All defective or damaged fans shall be replaced at no cost to the Owner.

C. Openings shall remain protected during storage. Immediately after installation and assembly, all factory protection shall be restored. Unit shall remain protected until just prior to final acceptance by Owner.

D. Use spreader bars on lifting cables when hoisting fans from lifting lugs to prevent cable damage to housing or components. Rig fans per fan manufacturer's recommendations.

E. Fans shall be installed as shown on drawings, in accordance with details, approved submittals and the fan Manufacturer's installation requirements and recommendations. Ensure fans are installed to allow easy accessibility for service or removal of fan components.

F. Provide and install supplemental steel, supports, isolators and hangers necessary to hang or mount fans. Coordinate final location and placement of intermediate steel and ductwork connections in field. Install suspended fans with supports attached to structural members.

G. Install any associated motors, drives, or other components that have been shipped loose. Fan shall be installed, made fully operation, and tested.

H. Install flexible inlet and discharge couplings to prevent vibration transmission to ductwork.

I. Inlet and discharge ductwork shall have a minimum straight run of two (2) fan diameters upstream and downstream of the fan.

J. Just prior to final acceptance fan shall be thoroughly cleaned of all grease, dirt, and dust, etc. Apply touch-up paint or touch-up coating after final cleaning to repair any damage to the finish.

K. Provide or coordinate the scope of work associated with the installation of fans as specified in the following sections:

1. Roof curbs
2. Vibration isolation
3. Sheet Metal accessories
4. Interconnection wiring and conduit from power source to fan connection (starter).

L. Perform the following tests and inspections prior to fan operation:

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.
3. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
4. Verify that cleaning and adjusting are complete.
5. Inspect fan scroll for debris or water.
6. Remove guards. Align and adjust belt tension, verify that fan wheel and motor rotate freely, and that bearing operation is smooth. Re-install belt guards.
7. Adjust damper linkages for proper damper operation.
8. Verify lubrication of bearings and other moving parts. Use proper bearing venting procedures, in particular at motor bearings. Use only grease type specifically recommended by fan mfr. Do not over-grease. Fill extended grease lines if not already filled, using mfr. recommended grease and proper venting procedures.
9. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
10. Verify proper motor and fan rotation.
11. Remove and replace malfunctioning units and retest as specified above.

3.2 FIELD QUALITY CONTROL

A. Each fan shall be field tested. Any deficiencies related to performance, manufacture or installation shall be corrected without cost to Owner.

END OF SECTION 23 3400

SECTION 23 3713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

C. Register: A combination grille and damper assembly over an air opening.

1.3 SUBMITTALS

A. Product Data: For each model indicated, include the following:

1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.

B. Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for diffusers, registers, and grilles with factory-applied color finishes.

D. Samples for Verification: Of diffusers, registers, and grilles, in manufacturer's standard sizes, showing the full range of colors. Prepare Samples from the same material to be used for the Work.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Sections.

B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Diffusers, registers, and grilles are scheduled at the end of this Section.

B. Diffusers, registers, and grilles are scheduled on Drawings.

2.2 SOURCE QUALITY CONTROL

A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

2.3 DIFFUSERS

A. Manufacturers:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Air Systems Components; Krueger Div.
   b. Price.
   c. Nailor Industries Inc.
   d. Titus.

2. Accessories: Include the following:

   a. Equalizer deflectors.
   b. Smudge ring.
   c. Plaster ring.
   d. Extractor.
   e. Blank-off panel.
   f. Operating keys.

2.4 REGISTERS

A. Manufacturers:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Air Systems Components; Krueger Div.
   b. Price.
   c. Nailor Industries Inc.
   d. Titus.

2. Accessories: Include plaster frame.

2.5 GRILLES

A. Manufacturers:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Air Systems Components; Krueger Div.
   b. Price.
   c. Nailor Industries Inc.
   d. Titus.

2. Accessories: Include plaster frame.

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. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

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 grid. 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 connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION 23 3713

SECTION 26 0500 – COMMON WORK RESULTS FOR ELECTRICAL

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 work of this Section.

B. This Section shall apply to all Division 26 Sections.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01 Sections.

1. Codes and standards
2. Quality assurance
3. Examination of drawings and premises
4. Substitutions
5. Alternates
6. Permits, fees, and inspections
7. Changes involving Electrical Work
8. Submittals
9. Project record documents
10. Delivery, storage, and handling
11. Warranty
12. Scope of work specified in Division 26 and Division 28 sections
13. Related work specified in other Divisions
14. Systems provided by Owner

B. Part II – Products:

1. This Section includes basic requirements for materials and installations for electrical work, including but not limited to:

    a. Sealing of openings
    b. Sleeves

C. Part III – Execution:

1. This section includes basic requirements for installations for electrical work.

    a. Electrical demolition work
    b. Temporary services
    c. Cutting and patching
    d. Chases and recesses
    e. Assembly and connection of equipment
    f. Field quality control

1.3 CODES AND STANDARDS

A. The electrical characteristics, physical properties, design, performance characteristics, methods of construction, all material, and the installation techniques shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:

1. ADA – Americans with Disabilities Act
2. AEIC – Association of Edison Illuminating Companies
3. ANSI – American National Standards Institute
4. ASTM – ASTM International, formerly known as American Society for Testing and Materials
5. BICSI – Building Industry Consulting Service International
6. FCC – Federal Communications Commission
7. ICEA – Insulated Cable Engineers Association
8. IEC – International Electrotechnical Commission
9. IEEE – Institute of Electrical and Electronics Engineers
10. MBC – Michigan Building Code
11. MIOSHA – Michigan Occupational Safety and Health Administration
12. NEC – National Electrical Code
13. NETA – InterNational Electrical Testing Association
14. NEMA – National Electrical Manufacturers Association
15. NFPA – National Fire Protection Association
16. OSHA – Occupational Safety and Health Administration
17. UL – UL, LLC, formerly known as Underwriters Laboratories, Inc.

1.4 QUALITY ASSURANCE

A. Furnish all labor, materials, equipment, technical supervision, and incidental services required to complete, test, and leave ready for operation the electrical systems as specified in the Division 26 Sections, Division 28 Sections that this section applies to per paragraph 1.1 Related Documents, and as indicated on Drawings.

1. The Electrical Drawings indicate the general design and extent of the electrical system. Comply with the Drawings as closely as actual construction of the building and the work of other Trades permit.

B. Perform all work in a first class and workmanlike manner in accordance with the latest accepted standards and practices for the Trades involved.

1. All equipment of the same or similar systems shall be by the same manufacturer.

C. Regulatory Requirements:

1. Codes, Standards, Ordinances, and Regulations: Perform all work in accordance with applicable Federal, State, and local ordinances and regulations. Perform all work to comply with Codes and Standards identified in these Specifications.

    a. Notify the Architect/Engineer before submitting a proposal should any changes in Drawings or Specifications be required to comply with the above codes, standards, ordinances, and regulations. After entering into a contract, make all changes required to comply with the above codes, standards, ordinances, and regulations without additional expense to the Owner.
    b. Barrier-Free Regulations: All materials and installations shall comply with the requirements of the State of Michigan Barrier-Free Regulations and with the Americans with Disabilities Act (ADA).

D. Field Measurements:

1. Drawings are not intended to be scaled for roughing-in or to serve as shop drawings. Take all field measurements required for fitting the installation to the building.

E. Sequencing and Scheduling: Sequence and schedule work in order to avoid interference with the work of other Trades. Be responsible for removing and relocating any work which in the opinion of the Owner's Representatives causes interference.

1.5 EXAMINATION OF DRAWINGS AND PREMISES

A. Before submitting the Bid, examine the Architectural, Mechanical, and other Trades' Drawings and Specifications.

1. Notify the Architect/Engineer should any discrepancies occur between the other Trades and the electrical work.
2. No additional charges will be allowed because of failure to make this examination or to include all materials and labor required for the electrical work specified in other Trades' documents.
3. The Architectural Drawings take precedence in all matters pertaining to the building structure, the Mechanical Drawings take precedence in all matters pertaining to the Mechanical Trades, and the Electrical Drawings take precedence in all matters pertaining to the Electrical Trades. However, where there are conflicts or differences between the Drawings for the various Trades, report such conflicts or differences to the Architect/Engineer who shall determine the course of action to be taken.

B. Before submitting the Bid, examine the premises to determine existing conditions for performing the electrical work.

1. Notify the Architect/Engineer should any discrepancies occur between the existing conditions and the electrical work.
2. No additional charges will be allowed because of failure to make this examination or to include all materials and labor required to complete the electrical work.

1.6 PERMITS, FEES, AND INSPECTIONS

A. Obtain all permits, licenses, inspections, and tests required. At the completion of the work, obtain and send certificates of inspections and approvals to the Architect/Engineer.

1. Pay all fees and expenses for permits, licenses, tests, and inspections.
2. A copy of the final approved inspection certificates for electrical work specified in all Division 26 Sections and Division 28 Sections that this section applies to per paragraph 1.1 Related Documents shall be provided as a requirement prior to final payment.

1.7 SUBMITTALS

A. The following is in addition to the requirements for submittals in Division 01.

B. Material List: Submit a complete list of all materials and equipment indicating their manufacturer for approval by the Architect/Engineer within 15 days after award of contract and prior to submittal of shop drawings.

C. Construction Schedule: Submit a construction schedule including milestone dates and lead times for major electrical equipment.

D. Provide equipment submittals in the form of letters of intent, product data or, shop drawings as specified for all materials provided on the project.

E. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4" x 5" on the label or beside the title block on shop drawings to record the review and approval markings and the action taken.

2. Include the following information on the label for processing and recording action taken.

    a. Project Name
    b. Date
    c. Name and address of Architect/Engineer
    d. Name and address of Contractor
    e. Name and address of Subcontractor
    f. Name and address of Supplier
    g. Name of Manufacturer
    h. Number and title of appropriate Specification Section
    i. Drawing number, identification mark, fixture type, panelboard number, specification section number, and detail references, or as noted on the Electrical Drawings.

F. Equipment submittals shall be reviewed by the Electrical Contractor for completeness and accuracy and prior to submitting to the Architect/Engineer for review. Submittals shall be dated and signed by the Electrical Contractor. Note on the submittal any and all exceptions or changes to the Drawings and Specifications required by the submittal to meet the specified products.

G. Partial submittals for equipment shall not be permitted. Where partial submittals are transmitted to the Architect/Engineer, they will be returned "Rejected".

H. Where the equipment submittals consist of manufacturer's standard detail drawings or schedules and contain data for a variety of similar equipment, indicate the data pertinent to the equipment furnished for this project only. Standard detail drawings and schedules not clearly indicating which data is associated with this Project shall be returned "Rejected".

I. Where accessories and/or options are specified and do not appear as part of manufacturer's standard detail drawings or schedules, state each accessory that is to be provided with the equipment on the standard detail drawings or schedules.

J. The letter of intent shall state that the product is exactly as specified with no exceptions and that the product is being manufactured by one of the specified manufacturers. The letter of intent shall include the specification section number, the product description, and the name of the selected manufacturer. The aforementioned information shall be typed on the Electrical Contractor’s letterhead.

K. Lighting fixture submittals shall be submitted as one (1) package including all fixtures intended to be used for this Project.

L. CADD files of the Electrical Drawings will be provided by the Architect/Engineer for this Contractor’s use in preparing submittals. Refer to Division 01 for the forms and procedures for requesting electronic files/media.

M. Layout Shop Drawings: Prepare layout shop drawings drawn to scale in electronic format and submit electronic copies in .PDF and .DWG formats to the Architect/Engineer for review. Refer to Division 01 for submittals and quantities.

1. Layout shop drawings shall show building floor plans to scale and shall include lighting and power distribution systems, all details of electrical construction, routing of conduits, wiring, circuiting, and related information necessary for the installation and future maintenance of the electrical wiring systems.

N. No apparatus or equipment shall be shipped from stock or fabricated until their equipment submittals have been reviewed and approved by the Architect/Engineer. By the review of submittals, the Architect/Engineer does not assume responsibility for actual dimensions or for the fit of completed work in position, nor does such review relieve Electrical Trades of full responsibility for the proper and correct execution of the work required.

1.8 PROJECT RECORD DOCUMENTS

A. Submit final project record documents as described in Division 01.

B. As-Built Drawings: At the completion of the work, submit to the Architect/Engineer the revised set of drawings in electronic file format indicating all changes from the bid documents using redlines, bubbles, or another approved method. The Drawings shall contain all title block information as originally issued by the Architect/Engineer with the addition of the Electrical Contractor's company name, address, telephone number, company's project number, date of issuance by the Electrical Contractor, and issued for "As-Built" in title.

C. Operation and Maintenance Manuals: The manuals shall contain operating instructions, service instructions, parts lists, etc., which are shipped with electrical equipment. At the completion of the work, transmit these items to the Owner. If this information is not shipped with the equipment, obtain it from the manufacturer.

D. Maintenance Materials: Retain all portable and detachable portions of the installation such as keys, tools, manuals, etc., until the completion of the work and then transmit them to the Owner and obtain itemized receipt. This receipt shall be provided as a requirement prior to final payment.

E. Record Documents Manual: At the completion of the work, furnish and deliver to the Owner and Architect/Engineer two (2) electronic sets on USB flash drive of the record documents manual.

1. One (1) copy of all shop drawings and product data
2. One (1) copy of operation and maintenance manuals
3. One (1) copy of as-built drawings

1.9 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Provide adequate storage space for all electrical equipment, conduit, and materials delivered to the job site under a weather protected enclosure. Location of the space will be designated by the Owner's Field Representative. Equipment set in place in unprotected areas must be provided with temporary protection.

1. Be responsible for the care and protection of electrical equipment until it has been fully tested and accepted.
2. Protect materials with permanent factory finish from damage by covering.
3. Protect conduit openings with temporary plugs or caps.

1.10 WARRANTY

A. Warranty: Provide a one-year parts and labor warranty from date of substantial completion for all equipment and installation. Comply with requirements of Division 01.

1. A copy of the warranty on the Electrical Contractor's letterhead shall be provided as a requirement prior to final payment.

1.11 SCOPE OF WORK SPECIFIED IN DIVISION 26 SECTIONS

A. Furnish all labor, materials, equipment, technical supervision, and incidental services required to complete, test, and leave ready for operation the electrical systems as specified in the Division 26 Sections, Division 28 Sections that this section applies to per paragraph 1.1 Related Documents, and as indicated on Drawings.

B. Provide control wiring greater than 100 volts for temperature, pressure, and level control devices and for solenoid valves, control relays, and all power wiring required for equipment specified hereinafter.

C. Provide empty raceway systems consisting of conduits, wireways, surface raceways, nylon pull strings, outlet boxes, pull boxes, cover plates, as indicated for wiring, for work specified in all Division 27 Sections, and for work specified in all Division 28 Sections.

1.12 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Furnishing and installing field prime and finish painting – Division 09, except as specified in Division 26 Sections and Division 28 Sections that this section applies to per paragraph 1.1 Related Documents.

PART 2 - PRODUCTS

2.1 SEALING OF OPENINGS

A. Seal openings around electrical materials (conduit, raceways, cable trays, panels, etc.) with fire and smoke stop systems where floors, fire rated walls, and smoke barriers are penetrated. Fiberglass is not acceptable. Fire and smoke stop systems shall be UL listed and shall have a fire rating equal to or greater than the penetrated barrier. Fire and smoke stop systems shall be in conformance with Division 07.

2.2 SLEEVES

A. Provide conduit sleeves where conduits pass through concrete floors, walls, beams, and ceilings.

B. Sleeves shall be galvanized rigid steel conduit. Do not use aluminum conduit. Where specific sizes are not indicated on the Drawings, sleeves shall be sized to provide one-half (1/2) inch clearance around the outside surface of the item for which they were installed. They shall be cut flush with wall surfaces and shall extend one inch, or as directed, through floor. Sleeves shall be packed with approved non-combustible packing material and sealed with sealant to prevent passage of air, liquid, or fumes from one area to another. The filler and sealant materials used shall be rated at least equal in fire resistance to the construction material being penetrated. Floor sleeves shall be sealed between floor and sleeve with concrete grout.

2.3 EXPANSION FITTINGS

A. Provide expansion fittings in all conduits that cross building expansion joints, and where exposed, and provide bonding jumpers where required to maintain electrical continuity.

PART 3 - EXECUTION

3.1 ELECTRICAL DEMOLITION WORK

A. General: Perform electrical demolition work in a systematic manner. Use such methods as outlined below to complete work indicated on the Drawings.

B. Obtain approval from the Owner prior to interrupting existing services. All service interruptions shall be at a time suitable to the Owner. Where the Owner approves service interruptions at times resulting in premium time work to this Contractor, this Contractor shall include the premium time in his Base Bid.

C. The associated raceway system (conduit, boxes, supports, etc.) and wire of equipment indicated to be demolished shall be removed from the equipment back to the source as noted below:

1. Power: Remove raceway system and wire back to the panel or power source.

    a. When the circuit originates from the panel and serves no other loads, remove raceway system and wire back to the panel, and relabel the associated circuit breaker or fused switch as “spare”.
    b. When the circuit originates from a panel but continues on to other loads not intended to be demolished, remove raceway system and wire back to first junction box.

c. When the removal of the circuit to the equipment to be demolished affects “downstream” devices not indicated to be demolished, re-feed “downstream” devices.

2. Fire alarm wiring: Remove as indicated on the Drawings. Fire alarm system shall remain operational during building occupied hours in all tenant occupied spaces.
3. Data system wiring, telephone wiring, or other auxiliary systems wiring: Remove raceway system and wiring back to communication room or other source.
4. Raceway systems in walls to remain: Abandon raceway systems in place and install blank cover plates.
5. Raceway systems above accessible ceilings or other accessible locations: Remove raceway systems.

D. Conduit being demolished that is installed in floor slabs shall be cut 1/2 inch below the floor, and the floor shall be patched.

E. Where applicable, existing in-place raceway systems (conduit, boxes, supports, etc.) may be reused for new work providing that the installation is in accordance with requirements for new work found in Division 26 Sections and Division 28 Sections that this section applies to per paragraph 1.1 Related Documents.

F. Where equipment or fixtures are removed, outlets shall be properly blanked-off and conduits shall be capped. After alterations are completed, the entire installation shall present a “finished” look, as approved by the Architect/Engineer. The original function of the present electrical work to be modified shall not be changed unless required by the specific revisions to the system as specified or as indicated.

G. Materials salvaged from this work shall not be reused except where reuse is specifically indicated.

H. Existing fixtures and electrical equipment removed, not reused, and not specifically indicated to be turned over to the Owner shall be legally and properly disposed of off Owner’s property.

I. Existing fixtures and electrical equipment specifically indicated to be turned over to the Owner shall be disconnected, removed, and turned over to the Owner in an undamaged condition to an onsite storage area as directed by the Owner.

3.2 TEMPORARY SERVICES

A. Provide temporary lighting.

3.3 CUTTING AND PATCHING

A. The cutting of holes through the existing building construction shall only be done by the use of abrasive saws and rotary coring machines. The use or hammer and drill points will not be permitted. The openings shall not be cut larger than necessary for the installation of the electrical work. Openings shall then be grouted in. Where existing piping, etc., is removed, the unused openings shall be grouted in.

B. The drilling or punching of structural members, such as holes through beams or columns, shall not be done without the specific permission of the Architect/Engineer.

C. Cutting of holes through floors and walls shall be done only at such locations as directed by the Architect/Engineer.

D. Cooperate with the other Trades so that all cutting and repairing in any given area will be done simultaneously.

E. Electrical work which may interfere with building systems uncovered by the cutting of new openings in the present building including but not limited to piping, ducts, or other mechanical equipment as well as conduits and outlets shall be removed at the direction of the Architect/Engineer.

3.4 ASSEMBLY AND CONNECTION OF EQUIPMENT

A. Assembly of Equipment:

1. The Contract Drawings and Specifications indicate items to be purchased and installed which are noted by a manufacturer's name, catalog number and/or brief description.
2. The catalog number may not designate all the accessory parts and appurtenances required for the particular use or function.
3. Arrange with the manufacturer for the purchase of all items required for the complete installation and efficient operation.

B. Equipment Connections:

1. Connections to equipment, lighting fixtures, etc., shall be made in accordance with the shop drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished.
2. Any and all additional connections not shown on the Drawings but called for by the equipment manufacturer's shop drawings or required for the successful operation of the particular equipment furnished shall be installed as part of this Contract at no additional charge to the Owner.

3.5 FIELD QUALITY CONTROL

A. Testing Ducts and Conduits: Ducts and conduits which are installed underground or concealed in concrete floor slab, foundations, etc., shall be cleared of foreign material and obstructions after installation and before conductor or pull wires are draw-in by wire brushing, swabbing, and employing an iron or hardwood mandrel which is 1/4" smaller in diameter than the internal diameter of the duct or conduit. Pulling wires shall be left in empty conduits.

B. Tests and Inspection:

1. When the systems are completed, operate equipment as directed by Architect/Engineer. Replace all faulty equipment. Make necessary adjustments before final acceptance.
2. Perform all tests required by State, City, County and/or other agencies having jurisdiction.
3. Provide all materials, equipment, etc., and labor required for tests.
4. Perform cable and equipment testing as specified.

C. Cleaning:

1. Keep premises free from accumulation of waste materials and rubbish. At the completion of the work, remove all rubbish from and about the building, and leave the electrical systems clean and ready for use.
2. Final clean-up shall include washing of fixture lenses, panels, lighting panels, etc., to remove shipping and/or construction dust and debris. Fixture reflectors and/or lenses with water marks or cleaning streaks will not be accepted.

END OF SECTION 26 0500

SECTION 26 0519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (0-600V)

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 work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Conductors and cabling for buildings and structures electrical systems under 600 volts.
2. Wire and cable systems as required, and all material and equipment, including wire, cable, connectors, lugs, fittings, and identification, as indicated or specified.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.

1. Conductors - Each type and size of wire and cable. Identify material, construction data, insulation thickness, and jacket thickness.

1.4 QUALITY ASSURANCE

A. Wire, Cable and Components: Listed by Underwriters' Laboratories as meeting National Electrical Code and NFPA 70 requirements and be so labeled.

B. Furnish wire and cable on which standard factory tests established by AEIC, ANSI, ASTM, ICEA and NEMA have been performed.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver all wire and cable to the site on reels or in coils, plainly marked for complete identification, including the wire or cable size, the number of conductors, type of wire or cable, length, weight, thickness and character of the insulation and the name of the manufacturer.

PART 2 - PRODUCTS

2.1 WIRE AND CABLE

A. General Requirements: Furnish wire and cable per standard specifications established for such material and construction by ASTM, ANSI, IPCEA and NEMA, where applicable. All conductors shall be copper. Minimum size of conductors shall be No. 12 AWG, except 120 volt control conductors which may be No. 14 AWG and 90 volt and less shall be as specified. Furnish conductor sizes as indicated. Conductors shall be stranded for sizes No. 14 AWG and larger. Conductors smaller than #14 AWG shall be as specified in the sections requiring use of such conductors.

1. Manufacturer: Provide products of one of the following:

a. Cerro Wire
b. Encore
c. General Cable Corporation
d. Prysmian
e. Republic Wire

f. Southwire
g. United Copper Industries

B. Wire for General Interior and Exterior Use: Single conductor, annealed copper, NEC Type XHHW, THHN and THHW rated 90°degC or THHN/THWN rated 90 degC in dry locations and 75 degC in wet locations, or NEC Type THW, THWN and XHHW rated 75 degC, all with 600 volt insulation.

C. Cable types MC, MI, NM, NMC or NMS shall not be used unless specifically noted on the drawings or in the specifications.

2.2 CONNECTORS FOR SPLICING COPPER CONDUCTORS

A. Connectors for Straight Splicing (Butt Splice) Conductors Up to and Including No. 8 AWG: Uninsulated solderless compression type.

1. Manufacturer: Provide one of the following:

a. Burndy "Hylink”
b. Panduit
c. Thomas & Betts "Sta-Kon"

B. Connectors for Straight Splicing Conductors No. 6 AWG and Larger: Uninsulated solderless compression 2-way type.

1. Manufacturer: Provide one of the following:

a. Burndy “Hylink”
b. Thomas & Betts 54500 Series

C. Connectors for Pigtail Splicing Conductors Up to and Including No. 8 AWG: Solderless type with a metallic insert connector within a plastic insulating cover having a temperature rating of 105 degC, 600 volts.

1. Manufacturer: Provide one of the following:

a. Buchanan
b. Ideal
c. Scotchlok

D. Connectors for 3-Way Splicing Conductors No. 6 AWG and Larger: Uninsulated solderless compression type.

1. Manufacturer: Provide one of the following:

a. Burndy “Hylink”
b. Thomas & Betts 54700 Series

E. Connectors for termination of motor loads to branch circuits: Set screw type, clean insulation for termination inspection multitap.

1. Manufacturer: Provide one of the following:

a. Burndy Clear UNITAP
b. Thomas & Betts CSB

2.3 LUGS FOR TERMINATING COPPER CONDUCTORS

A. Lugs for Terminating Power Conductors Up To and Including No. 8 AWG: Solderless type, manufacturer's standard, unless otherwise specified.

B. Lugs for Terminating Power Conductors No. 6 AWG and Larger: Solderless compression type, one hole for No. 6 AWG through No. 4/0 AWG inclusive, and two hole for larger sizes.

1. Manufacturer: Provide one of the following:

a. Burndy Type YA-L
b. Thomas & Betts Series 54000

C. Lugs for Terminating Control and Switchboard Wiring: Solderless compression type with tinned ring tongue.

1. Manufacturer: Provide one of the following:

a. Burndy "Hylug"
b. Thomas & Betts "Sta-Kon"

2.4 MISCELLANEOUS

A. Wire Labels for Identification of Conductors.

1. Manufacturer: Provide products of one of the following:

a. Brady
b. Westline

B. Lubricating Compound:

1. Manufacturer: Provide products of one of the following:

a. American Polywater Corporation
b. Ideal 77 Yellow
c. Wire Lube

PART 3 - EXECUTION

3.1 GENERAL

A. Install all wiring in raceway systems unless otherwise specified. Install wiring only in completed raceway systems and when systems are protected from the weather. Install conductors continuous, without splices, between equipment, where possible. Where splices are required, make up splices in boxes; do not use fittings for same.

B. Install phase and neutral conductors of each branch or feeder circuit in a single conduit except where paralleling circuits are indicated. Install paralleling circuits of identical makeup and length as the paralleled circuit, and terminate conductors at the same location, mechanically and electrically, at both ends, to ensure equal division of the total current between conductors.

C. All 120 volt branch circuits exceeding 100 feet in length shall be minimum size #10 AWG.

D. For interior branch circuits, provide a separate neutral conductor for each phase conductor for circuits supplying 120 volt convenience receptacles. Sharing neutrals between phase conductors shall not be permitted.

E. Continuously lubricate all non-armored cables of the larger sizes at the pull-in point of conduit systems with an approved compound compatible with conductor insulation or jacket.

F. Install conductors in such a manner that the bending radius of any wire or cable is not less than the minimum recommended by IPCEA and/or the manufacturer. Do not exceed manufacturer's recommended values for maximum pulling tension applied to any wire or cable.

G. Connect all power wiring to equipment such that phasing shall be A-B-C-N left to right, top to bottom and front to back, where possible, and permanently identify phasing on the structure or housing adjacent to bus. Phase identification A-B-C is equivalent to transformer phase identification X1-X2-X3 and H1-H2-H3.

H. Connect phase wiring to all 3 phase receptacles to insure the same phase rotation in all receptacles with interchangeable plugs.

3.2 COLOR CODING, CONDUCTOR AND CABLE IDENTIFICATION

A. Provide single conductor cables having black insulation for power feeders and subfeeders. Identify individual feeder and subfeeder conductors as to phase connection and voltage by means of wire labels and color coding at each pull box, junction box, manhole, handhole, vault, lighting fixture handhole, splice and termination.

B. Refer to Section 260553 “Identification for Electrical Systems” for conductor and cable identification requirements.

3.3 SPLICES AND TERMINATIONS

A. Splice and terminate conductors with connectors and lugs as specified for the specific size and type of conductor. Do not splice armored cable except where cable lengths are limited by reel capacity. Do not splice direct burial cable underground. Indent all compression type connectors and lugs with tools as recommended by the connector or lug manufacturer.

B. Thoroughly clean wire ends before connectors or lugs are applied. Before installing a compression connector or lug on an aluminum conductor, apply an aluminum joint compound to the exposed conductor and wire brush through the compound to remove the aluminum oxide film. Install the connector or lug immediately after wire brushing the conductor.

C. Whenever aluminum or copper lugs are terminated on aluminum bus, use a Belleville washer and two tin or cadmium plated washers, one on each side in combination with aluminum joint compound on all contacting surfaces. Tighten bolts until Belleville washer is flat.

D. Insulate all bare surfaces of conductors with a minimum of four layers (half lap in two directions) of electrical insulating tape. On larger splices and terminals, build up connection with electrical insulating putty before applying tape, to eliminate both sharp edges and voids.

E. Terminate all armored cables at equipment with an approved type of armored cable terminator and terminate cable ground conductors on equipment ground bus. Where splices are required in armored cables, use approved splicing sleeves. Locate splicing sleeve outside of and adjacent to the tray, not in the tray.

END OF SECTION 26 0519

SECTION 26 0526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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 work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Grounding Conductors:

a. In Conduit with Copper Phase Conductors: Insulated copper.

2. Grounding Connections:

a. To Non-Permanently Fixed Equipment: Lugs bolted to the equipment.
b. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
c. All Other Locations: Bolted connectors.

3. Markers and Identifiers

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Ground electrical system neutrals and non-current carrying parts of electrical equipment per the minimum requirements of NFPA 70 National Electrical Code, except where additional requirements are indicated or specified.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 National Electrical Code by a Nationally Recognized Testing Laboratory (NRTL) acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

C. Comply with UL 467 for grounding and bonding materials and equipment.

D. Furnish tests on grounding systems as specified in Section 260570.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.

B. Letter of Intent: Submit a letter of intent stating compliance with drawings, specifications, and code:

1. Grounding conductors
2. Grounding connectors
3. Markers and identifiers

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. Bare Grounding Conductors: Stranded annealed copper.

B. Insulated Copper Grounding Conductors: Single conductor, stranded annealed copper, NEC Type THHN/THWN insulation rated 90 degC in dry locations and 75 degC in wet locations or NEC Type THHN/THWN-2 or XHHW-2 insulation rated 90 degC in dry and wet locations, 600 volts, color-coded green. Conductor No. 10 AWG and smaller may be solid in lieu of stranded.

C. Manufacturer: Provide products of one of the following, unless otherwise noted:

1. Cerrowire
2. Encore Wire
3. Prysmian Group
4. Republic Wire
5. Southwire

2.2 GROUNDING CONNECTIONS

A. Mechanical-Type Bus-Bar Connectors: Cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

B. Compression-Type Bus-Bar Connectors: Copper or copper alloy, with two wire terminals.

C. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

D. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

E. Conduit Hubs: Mechanical type, terminal with threaded hub.

F. Straps: Solid copper, cast-bronze clamp or copper lugs. Rated for 600 A.

G. Manufacturers: Provide products of the following, unless otherwise noted:

1. ABB Thomas & Betts including Blackburn
2. Emerson Appleton
3. Emerson O-Z/Gedney
4. Hubbell Anderson
5. Hubbell Burndy
6. nVent Erico
7. Penn Union

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install conductors of minimum size required by NFPA 70 National Electrical Code except where sizes exceeding the requirements are indicated.

B. Thoroughly clean all bonding surfaces of non-conducting materials. Where bolted connections are used, treat surfaces with a corrosion-inhibiting compound.

C. Where insulated conductors are used, thoroughly tape all exposed splices and connections. Encapsulate below grade splices and connections so that bare conductors are not in contact with earth.

D. Where metallic conduit is used for mechanical protection of a ground conductor, bond conductor to the conduit at each end.

E. For electrical system neutral grounding, do not use conductor sizes smaller than No. 8 AWG.

F. Lighting branch circuits in EMT or flexible conduit and lighting fixture cord and plug assemblies shall have an equipment grounding conductor.

G. Provide an equipment grounding conductor, within the raceway along with phase conductors, for all feeders and branch circuits.

H. Provide an equipment grounding conductor within all flexible conduits.

END OF SECTION 26 0526

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Aluminum slotted support systems.
3. Nonmetallic slotted support systems.
4. Conduit and cable support devices.
5. Support for conductors in vertical conduit.
6. Structural steel for fabricated supports and restraints.
7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
8. Fabricated metal equipment support assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

B. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M,Grade A325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101
3. NECA 102.
4. NECA 105.
5. NECA 111.

B. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 26 0533 "Raceways and Boxes for Electrical Systems."

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. 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.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

END OF SECTION 26 0529

SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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 work of this Section.

1.2 SUMMARY

A. Conduits, boxes and all associated fittings, as indicated or specified.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.

B. Letter of Intent: Submit a letter of intent stating compliance with drawings, specifications, and code:

1. Conduits and fittings
2. Boxes
3. Miscellaneous items

C. Product Data: Submit complete product data on each item:

1.4 QUALITY ASSURANCE

A. Work in Hazardous Areas shall be in accordance with Article 500 of the National Electrical Code.

B. All products specified herein shall be listed by a Nationally Recognized Testing Laboratory (NRTL). Where indicated, products shall be listed by an NRTL to a UL standard. The following are not required to be listed.

1. Pull and junction boxes, except when used in wet locations
2. Trapeze hangers
3. Sealants

PART 2 - PRODUCTS

2.1 METALLIC CONDUITS

A. Rigid Galvanized Steel (RGS) Conduit, Elbows and Couplings: Zinc-coated hot dip galvanized threaded steel per ANSI C80.1 and listed to UL 6. Each length of conduit shall be threaded on both ends.

1. Manufacturer: Provide products of one of the following:

a. Atkore Allied Tube & Conduit
b. Nucor Tubular Products
c. Wheatland Tube

B. Electrical Metallic Tubing (EMT): Zinc-coated steel per ANSI C80.3 and listed to UL 797.

1. Manufacturer: Provide products of one of the following:

a. Atkore Allied Tube & Conduit
b. Nucor Tubular Products
c. Wheatland Tube

C. Flexible Steel Conduit: Continuously interlocked, zinc-coated steel core, listed to UL 1.

1. Manufacturer: Provide products of one of the following:

a. Anamet Electrical, Inc.
b. Atkore AFC Cable Systems
c. Electri-flex
d. Southwire

2.2 METALLIC CONDUIT FITTINGS

A. Fittings for Flexible Steel Conduit: Malleable iron or steel, zinc or cadmium plated, securing the conduit by clamping action around the periphery of the conduit. Do not furnish fittings that anchor the conduit by means of set screws.

1. Manufacturer: Provide products of one of the following:

a. ABB
b. Eaton Crouse-Hinds
c. Emerson Appleton & O-Z/Gedney
d. Hubbell

B. Locknuts for RGS Conduit: Malleable iron or steel, zinc or cadmium plated.

C. Bushings for 1 Inch and Smaller RGS Conduit: Insulating plastic type of non-burnable thermosetting phenolic, conforming to UL requirements. Do not furnish non-rigid plastic bushings.

D. Bushings for 1-1/4 Inch and Larger RGS Conduit: Malleable iron or steel, zinc or cadmium plated, with insulating insert of thermosetting plastic as specified for smaller conduit bushings, molded and locked into the bushing ring.

2.3 OUTLET BOXES

A. Steel Sheet Metal Boxes: Galvanized or sherardized stock not less than No. 14 gage, with knockout openings, single or multiple gang, with extensions, adapters, plaster rings, tile covers, fixture studs and cover plates. Furnish accessories with same gage and finish as specified for boxes, except where special finishes are specified for covers and device plates in Section 26 2726. Provide sizes per NEC requirements for wiring space, except where minimum sizes are specified under Part 3.

1. Manufacturer: Provide products of one of the following:

a. ABB Steel City
b. Eaton Crouse-Hinds
c. Hubbell RACO

B. Cast or Malleable Iron Boxes: Zinc or cadmium plated, or galvanized, single or multiple gang, with taper threaded hubs, adapters and cover plates. Furnish cast metal, galvanized or cadmium plated accessories, except where special device plates are specified in Section 26 2726. Furnish gaskets when located in areas requiring gaskets as specified in Part 3. Provide sizes per NEC requirements for wiring space, except where minimum sizes are specified under Part 3.

1. Manufacturer: Provide products of one of the following:

a. ABB
b. Eaton Crouse-Hinds
c. Emerson Appleton & O-Z/Gedney
d. Hubbell

2.4 PULL AND JUNCTION BOXES

A. Boxes Less than 5 Inches by 5 Inches: Conform to requirements specified for Outlet Boxes.

2.5 WIREWAYS

A. Steel Wireway: Code gage, galvanized, full seam welded with bent-in flanges seam welded at corner joints, removable cover secured to box with zinc plated hardware including hinges and machine screws, with or without knockout openings, NEMA type 1 in dry locations, NEMA type 3R in damp or wet locations or outdoors, listed for wet locations when used in such locations, listed to UL 870 and conforming to NFPA 70 National Electrical Code Article 376. Provide sizes conforming to NEC requirements for wiring space, except where boxes of larger size are indicated. Furnish gaskets when required to meet NEMA type.

1. Manufacturer: Provide products of one of the following:

a. Eaton
b. Hubbell
c. nVent Hoffman
d.

PART 3 - EXECUTION

3.1 CONDUIT SYSTEMS

A. Use EMT as follows:

1. In dry locations not subject to physical damage; when the conduit is installed in industrial type locations or locations subject to vibration, otherwise install set screw connectors and couplings.

B. Use RGS conduit as follows:

1. In outdoor locations.
2. In damp locations.
3. In wet locations.
4. As vertical riser routed above grade from below grade with RGS conduit elbow below grade.
5. As vertical riser routed through building floor slab with RGS conduit elbow in or below building floor slab.

C. Use flexible steel conduit as follows:

1. In dry locations for final connection to recessed lighting fixtures and under-counter lighting fixtures, minimum 1/2 inch trade size; maximum six feet in length.

2. In dry locations for final connection to distribution transformers in electrical rooms; maximum six feet in length.

D. Install conduit systems as indicated, as required by the NEC, and as specified. Install conduit sizes as indicated. Where conduit sizes are not indicated, install sizes per NEC requirements, except do not use conduit sizes smaller than 3/4 inch. The use of 1/2 inch conduit is permitted from receptacle outlet boxes and switch outlet boxes to the nearest junction box mounted in the ceiling space. Use 3/4 inch conduit minimum from the panelboards to the junction boxes and between junction boxes. Use 1/2 inch fixture stems optionally, unless otherwise indicated.

E. Install concealed conduit in offices and other finished areas; install exposed conduit in all other areas, unless otherwise indicated or specified.

F. Do not install crushed or deformed conduits and avoid trapped runs in damp or wet locations. Take care to prevent the entrance of water and the lodging of concrete, plaster, dirt or trash in conduit, boxes, fittings and equipment during the course of construction. Free conduit of obstructions or replace the conduits. Where conduit joints occur in concrete slabs, or in damp or wet locations, make joints watertight by applying an approved compound on the entire thread area before assembling. Draw up all conduit joints as tightly as possible. Cap exposed empty conduits which do not terminate in outlets, panels, cabinets, etc., with standard galvanized plumbers pipe caps. Plug empty conduits which terminate flush with floors or walls with flush coupling and brass plug.

G. Install conduit sleeves for all exposed conduits and cables passing through walls, ceilings or floors, and fill the void between sleeve and conduit with sealant flush with the end of the sleeve to seal the opening.

1. For conduit sleeves passing through fire rated walls, floors or ceilings, comply with requirements of Division 07 Firestop Systems.

H. Terminate conduit stubbed up through concrete floors for connections to free standing equipment with a coupling flush with finish floor, and extend rigid conduit to equipment, except that where required, use flexible conduit from a point 6 inches above the floor.

I. Make changes in direction of runs with symmetrical bends, fittings or pull boxes. Do not use bends around outside corners; use fittings for same. Install elbows, bends and offsets having a minimum radius of curvature of 24 inches for 2 inch and 2-1/2 inch conduit, and 36 inches for 3 inch and larger conduit. Except where conduit runs are shown in exact detail, install pull points at not greater than 200 foot intervals in straight runs. Where bends are included between pull points, reduce this maximum permissible 200 foot separation between pull points by 50 feet for each 90 degree bend and 25 feet for each 45 degree bend. Figure deductions for all other angle bends on a similar basis. When bends are made in the field, make bends with an approved hickey or conduit bending machine. Make bends in 1-1/4 inch and larger conduits with standard conduit ells where possible.

J. Provide conduit nipples with two independent sets of threads. Do not use running threads on any part of the conduit system. Where conditions require joining two fixed conduits into a continuous run, use a conduit union, in place of running threads and coupling.

K. Install expansion fittings in exposed conduit runs of excessive length, where conduits cross building expansion joints, and where indicated.

L. Install double locknuts and bushings on all rigid conduit terminations into threadless openings. Increase length of conduit threads at terminations sufficiently to permit the bushing to be fully seated against the end of the conduit.

M. Use one hole malleable iron galvanized pipe straps for support of single conduits, or clevis type hangers. Support groups of conduits on trapeze hangers. Use threaded rod or pipe for hanger support. Do not use perforated strap or wire for conduit or hanger support. Use beam clamps or malleable iron or wrought steel with hook rods to grip the beam flange for conduit or hanger support; do not use C-clamp type fittings.

Support exposed conduit at least every 8 feet if smaller than 2 inch, and every 10 feet if 2 inch and larger unless otherwise noted.

N. Install nylon pull string in empty conduits.

3.2 OUTLET, SWITCH, PULL AND JUNCTION BOXES

A. Outlet Boxes for Use with EMT and Flexible Steel Conduit: Steel sheet metal outlet boxes.

B. Pull and Junction Boxes for Use in Non-Hazardous Areas Indoors: Steel sheet metal.

C. Flush Mounted Boxes: For single gang outlets and two gang outlets, use boxes not less than 4 inches square and 2-1/8 inches deep with single gang and two gang plaster reducing ring. For multiple outlets, use gang type boxes not less than 2-1/4 inches deep. Plaster rings shall not be less than 3/4 inches deep. For ceiling outlets in concrete slabs, use boxes not less than 3 inches deep.

D. Gaskets: Provide cover gaskets for boxes in damp or wet locations and in utility or industrial areas.

E. Install boxes in the wiring or raceway systems as required for pulling of wires, making connections, and mounting of devices and fixtures.

F. Install extension rings, adapters, raised covers and plaster rings on flush mounted boxes as required. Equip flush mounted boxes in masonry block or tile walls with tile covers.

G. Locate outlets in offices and other finished areas with due regard for the finish and interior architectural treatment so that outlets are centered with respect to panels, joints or moldings, and so that plaster rings, frames and tile covers are properly located with respect to the finished surface.

H. The mounting height of recessed junction or outlet boxes in block or brick walls may be adjusted to the nearest horizontal coursing as long as the specified mounting height is not exceeded. The cover plate shall conceal the grout line.

I. Install outlets for wall switches controlling lighting on the latch side of door where possible.

J. Support boxes independent of conduit and secure rigidly in place. Install boxes used for fixture support such that they are capable of carrying 100 pounds.

END OF SECTION 26 0533

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment identification nameplates

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 [and IEEE C2].

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, 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 EQUIPMENT IDENTIFICATION NAMEPLATES

A. Engraved, Plastic Laminate or Laminated Acrylic: Punched or drilled for screw mounting. Black engraved letters on a white face. Minimum letter height shall be 1/4 inch.

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. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50 foot maximum intervals in straight runs, and at 25 foot maximum intervals in congested areas.

3.2 EQUIPMENT IDENTIFICATION NAMEPLATES

A. Equipment Identification Nameplates: On each unit of equipment, install unique designation label that is consistent with one line diagram tag nameplates, wiring diagrams, schedules, and the Operation and Maintenance Manual

1. Labeling Instructions:

   a. Indoor and Outdoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/4 inch high letters on 1-1/2 inch high label.
   b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   c. Fasten nameplates with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

   a. Panelboards: Both panelboard identification label and typewritten directory of circuits.

END OF SECTION 26 0553

SECTION 26 0923 – LIGHTING CONTROL DEVICES

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 Work of this Section.

B. Related Sections

1. Section 26 2726 “Wiring Devices” for line voltage toggle switches, faceplates and device colors.
2. Section 26 0553 “Identification of Electrical Systems”

1.2 SUMMARY

A. This Section includes the following:

1. The objective of this section is to ensure the proper installation of the following lighting control devices not specified in other sections:

    a. Wall switch sensors
    b. Combination Wall Switch Sensors with Dimming
    c. Non-digitally addressable Indoor Occupancy Sensors
    d. Power Packs
    e. Unit Emergency Automatic Load Control Relays (ALCR)

2. Contractor’s work to include all labor, materials, tools, appliances, control hardware, sensors, wire, junction boxes and equipment necessary for and incidental to the delivery and installation of devices specified herein
3. The occupancy sensor-based lighting control devices shall accommodate all conditions of space utilization and all irregular work hours and habits.
4. The location and quantities of sensors shown on the Drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. Provide additional sensors as required to properly and completely cover the respective room.

1.3 SUBMITTALS

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

B. Shop Drawings: Provide wiring and installation details for all devices specified herein.

1. Lighting plans indicating location, orientation, and coverage area of each sensor and each emergency lighting controls devices. The locations and quantities of sensors and transfer devices indicated on the Drawings are diagrammatic and indicate only the rooms which are to be provided with sensors and emergency lighting. Provide layout shop drawings indicating all emergency lighting controls devices and all sensors including any additional sensors required to cover the respective areas properly and completely. Include locations of emergency lighting controls devices.
2. Interconnection diagrams showing field-installed wiring.
3. Coordinate these shop drawings with interfacing systems specified in other sections.

C. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.4 WARRANTY

A. Contractor shall warrant all equipment furnished in accordance with this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The suppliers obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty shall be for a minimum period of one (1) year.

1.5 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. Products supplied shall be from a single manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

C. All components shall be U.L. listed and meet all state and local applicable code requirements.

D. Wall switch products shall be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

E. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the occupancy sensor system.

F. It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system. A minimum of four (4) hours at the jobsite building shall be included for training.

1.6 COORDINATION

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, fire-suppression system, and partition assemblies.

B. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

PART 2 - PRODUCTS

2.1 WALL SWITCH SENSOR

A. Device shall be provided with momentary contact pushbutton(s) in configuration shown on plan (1 zone, 2 zone, etc). with integral occupancy sensor and shall be provided with (1) auxiliary contact for HVAC control. Auxiliary contact may be a remote power pack located nearby in an accessible ceiling space if not provided as integral. Auxiliary contact shall be automatically controlled by occupancy sensor and shall not be controlled by additional "fan button".

B. Switching mechanism shall be latching air gap relay, compatible with electronic power supplies, and inductive loads. Triac and other harmonic generating devices shall not be allowed. Zero Crossing Circuitry shall be used to increase the relay life, protect from the effects of inrush current, and increase the sensor's longevity.

C. Device shall utilize dual-technology sensing technologies to detect both small and large motion. Small motion detection coverage pattern shall be a minimum of 625 sf and large motion coverage shall be a minimum of 2025 sf. PIR coverage shall be provided wall-to-wall with a 180 degree field of view.

D. Device shall be capable of being wired in multi-way configurations without loss of functionality.

E. Sensor shall utilize signal technology to provide immunity to RFI and EMI.

F. Device shall be capable of being wired in multi-way configurations without loss of functionality.

G. Sensor shall operate at either 120 VAC or 277 VAC and shall be capable of switching 0 to 800 watt load or 1/4 hp @ 120 volts, 60 Hz; 0 to 1200 watt load of 1/4 hp @ 277 volts, 60 Hz.

H. Device shall be provided with integral daylight harvesting sensor and programmed as indicated on drawings. Daylight harvesting sensor shall be disabled if not indicated for use on drawings.

I. Device shall have an operating range of 32 degrees F to 140 degrees F, and up to 90% humidity (non-condensing).

J. The sensor shall utilize terminal style wiring. Sensor shall provide automatic equipment grounding to a metal junction box, and provide grounding to a metal cover plate.

K. Sensor shall have 100% off switch with no leakage current to load in OFF mode. In the event there is an open circuit in the AC line such as a ballast or lamp failure, the sensor shall automatically switch to OFF mode.

L. Manufacturer: Provide the following:

1. Sensor Switch WSX Series

2.2 COMBINATION WALL SWITCH SENSORS WITH DIMMING

A. Device shall be provided with integral 0-10V dimming pushbuttons and shall be programmable to set both minimum and maximum dimming levels.

B. Switching mechanism shall be latching air gap relay, compatible with electronic power supplies, and inductive loads. Triac and other harmonic generating devices shall not be allowed. Zero Crossing Circuitry shall be used to increase the relay life, protect from the effects of inrush current, and increase the sensor’s longevity.

C. Device shall utilize dual-technology sensing technologies to detect both small and large motion. Small motion detection coverage pattern shall be a minimum of 625 sf and large motion coverage shall be a minimum of 2025 sf. PIR coverage shall be provided wall-to-wall with a 180 degree field of view.

D. Device shall be capable of being wired in multi-way configurations without loss of functionality.

E. Sensor shall utilize signal technology to provide immunity to RFI and EMI.

F. Device shall be capable of being wired in multi-way configurations without loss of functionality.

G. Sensor shall operate at either 120 VAC or 277 VAC and shall be capable of switching 0 to 800 watt load or 1/4 hp @ 120 volts, 60 Hz; 0 to 1200 watt load of 1/4 hp @ 277 volts, 60 Hz.

H. Device shall be provided with integral daylight harvesting sensor and programmed as indicated on drawings. Daylight harvesting sensor shall be disabled if not indicated for use on drawings.

I. Device shall have an operating range of 32 degrees F to 140 degrees F, and up to 90% humidity (non-condensing).

J. The sensor shall utilize terminal style wiring. Sensor shall provide automatic equipment grounding to a metal junction box, and provide grounding to a metal cover plate.

K. Sensor shall have 100% off switch with no leakage current to load in OFF mode. In the event there is an open circuit in the AC line such as a ballast or lamp failure, the sensor shall automatically switch to OFF mode.

L. Manufacturer: Provide the following:

1. Sensor Switch WSX Series

2.3 NON-DIGITALLY ADDRESSABLE INDOOR OCCUPANCY SENSORS

A. Device shall utilize dual-technology sensing technologies to detect both small and large motion. Coverage patterns shall be optimized for intended use based on drawings. Provide optimizing lenses for:

1. Small Spaces - Small Motion, 500sf coverage pattern when mounted at 9ft.
2. High Mount - Large Motion, 15ft radial coverage pattern when mounted at 35ft. (PIR Sensing only).
3. Elongated Coverage - Large Motion detection for Hallways, Corridors, etc.

B. Detection shall be maintained when a person is seated and performing normal work tasks, such as reading or writing at a desk.

C. Sensor shall be capable of corner mounting to a wall or ceiling in order to eliminate detection through open doorways and outside of controlled area. To provide superior small motion detection and immediate activation upon entry, coverage of both technologies must be complete and overlapping throughout the controlled area.

D. Sensor shall utilize mixed signal technology to provide immunity to RFI and EMI.

E. Sensor shall have an additional single-pole, double-throw isolated relay with normally open, normally closed, and common outputs. The isolated relay shall be used with HVAC control, data logging, and other control options.

F. Sensors shall be field adjusted to operate as follows:

1. Manual on via wall switch when wall switch indicated.
2. Auto on when no wall switch is indicated.
3. Auto off with time delay set to 5 minutes.
4. Hold on when either technology detects occupancy.
5. Off when both technologies indicate no occupancy.

G. Manufacturer: Provide the following:

1. Sensor Switch CM-PDT-R or WV-PDT-16-R

2.4 POWER PACKS

A. Power pack shall be a self-contained transformer and relay module. Power pack shall have ½" snap-in nipple for ½" knockouts and mounting on outside of enclosure.

B. Power pack shall have dry contacts capable of switching 20 amp ballast and incandescent load @ 120 VAC, 60 Hz; 20 amp ballast @ 277 VAC, 60 Hz; 1 hp @ 120-250 VAC, 60 Hz. Power pack shall have primary dual-voltage inputs of 120/277 VAC. Power pack shall provide a 24 VDC, 150 mA output, with the relay connected.

C. Power pack shall be capable of parallel wiring without regard to AC phases on primary. Power pack can be used as a stand-alone, low voltage switch, or can be wired to sensor for auto control.

D. Power pack shall have hold-ON and hold-OFF inputs for integration with lighting control panels, building management systems, and other building systems.

E. Power pack shall have overcurrent protection if the low voltage current drawn exceeds 150 mA. In the event of an overcurrent, the low voltage output current shuts down and the LED will blink to indicate a fault condition. Power pack shall utilize Zero Crossing Circuitry to protect from the effects of inrush current and increase product longevity.

F. Power pack shall have an LED to indicate status of relay.

G. Power pack shall be UL 2043 plenum rated and shall have low voltage Teflon coated leads, rated for 300 volts.

H. Manufacturer: Provide the following:

1. Sensor Switch MP-20

2.5 UNIT EMERGENCY AUTOMATIC LOAD CONTROL RELAY (ALCR)

A. The ALCR shall be UL 924 listed and consist of a voltage sensor and automatic load control relay. The ALCR shall automatically switch and, where indicated, dim emergency lighting fixtures with normal lighting; upon loss of normal power or signal from the fire alarm system, emergency lights shall provide 100% light output. The ALCR shall be designed for fail-safe operation. The ALCR shall be rated for LED loads, suitable for connection to 20 amp normal-power and 20-amp emergency-power circuits and rated 120 or 277 volts as required. The ALCR shall control lighting in conjunction with occupancy sensors, photocells, time clocks and other control devices and shall be warranted for five (5) years.

B. Where light fixtures are controlled with dimming controllers, the ACLR shall be compatible with the dimming method.

C. Where the ALCR serves lighting in a space provided with manual controls to allow transient occupants to adjust the lighting (instructional areas, offices, meeting areas, etc.), the unit shall not utilize a time delay to perform a self-test.

D. Locate the ALCR above the lighting control station or switch at the main point of entry to the space.

E. The ALCR shall have a low voltage input for connection to a fire alarm system dry contact.

F. Refer to the drawings for additional requirements.

G. Manufacturer: Provide the following:

1. Bodine; BLCD16DIM or GTDU for dimming and non-dimming.

2.6 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: No. 12 AWG (minimum), complying with Division 26 Sections.

B. Power Wiring to Supply Side of Emergency Emergency lighting controls devicess No. 12 AWG (minimum), complying with Division 26 Sections.

C. Control wiring for dimming to LED fixtures #14 AWG minimum 600V complying with Division 26 sections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the Drawings are diagrammatic and indicate only the room which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

B. Proper judgment shall be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

C. Mount equipment at locations indicated.

D. Install devices in outlet boxes as specified in Section 26 0533 "Raceways and Boxes for Electrical Systems" unless otherwise specified in this Section. Mount devices at uniform heights above the floor for various areas as indicated.

E. Install plates on flush mounted devices with all four edges in continuous contact with finished wall surfaces without the use of plaster mats or similar devices. Do not use plaster or similar fillings. Install plates vertically, unless otherwise noted, with an alignment tolerance of 1/16 inch.

3.2 EMERGENCY ALCR INSTALLATION

A. Install caution labels indicating two power sources at the device and at each load or fixture supplied by the device. Do not install behind the wall switch. Extend independent emergency raceway and wiring to emergency fixtures.

B. Locate the ALCR above the lighting control station or switch at the main point of entry to the space or within the source electrical closet.

C. Label ALCR with source and load. Refer to 26 0553 "Identification for Electrical Systems".

D. Refer to drawings for additional requirements.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Sections. All wiring shall be installed in conduit. Minimum conduit size shall be ¾ inch.

B. Wiring Within Enclosures: Bundle, lace, and train conductors to terminal points. 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.

E. 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.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Sections.

B. All emergency power systems junction box covers, conduit couplings and panels shall be painted orange.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify actuation of each sensor and adjust time delays.

B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 FACTORY COMMISSIONING

A. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustment and sensor placement to ensure a trouble-free occupancy-based lighting control system. This service shall be provided with the base bid contract.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two (2) visits to site outside normal occupancy hours (4 hour minimum duration each) for this purpose.

END OF SECTION 26 0923

SECTION 26 2416 - PANELBOARDS

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 work of this Section.

1.2 SUMMARY

A. Circuit breaker single phase general service panelboards.

B. Provide equipment supports and identification as specified.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 01 Specification Sections.

B. Submit shop drawings and complete product data on each item. Coordinate the items as they relate to the work, prior to submittal. Shop drawings shall include:

1. All panelboards.

1.4 QUALITY ASSURANCE

A. Comply with NEC Article 384 as applicable to the installation of panelboards, cabinets, and cutout boxes.

B. Comply with applicable requirements of UL 67 “Electric Panelboards”, and UL 50, UL 869, UL 486A, and UL 1053 pertaining to panelboards, accessories and enclosures. Provide units that are U.L. listed and labeled.

C. Where indicated or used, provide service entrance type equipment and accessories and label “SUITABLE FOR USE AS SERVICE EQUIPMENT”. Provide all service entrance features per NEC and U.L.

D. Comply with NEMA Stds. Pub./No. 250 “Enclosure for Electrical Equipment (1000 Volts Maximum)”, Pub./No. PB 1 “Panelboards”, and Pub./No. PB 1.1 “Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less”.

PART 2 - PRODUCTS

2.1 CIRCUIT BREAKER GENERAL SERVICE PANELBOARDS - 208/120 VOLT

A. General Description: Dead front type, per NEMA Standard PB 1 and UL 67, and consisting of a 3 phase 4 wire solid copper neutral main bus with main lugs or main circuit breaker as indicated, and branch circuit breakers, all in a flush, surface or column mounted steel cabinet as indicated.

B. Ratings: As indicated on the panel schedules.

C. All bus bars shall be designed on the basis of 1000 amperes per square inch of cross sectional area for copper bus, and 500 amperes per square inch for lugs and connections.

D. Circuit Breakers: Bolt-in molded plastic case type, AC rated 1, 2, or 3 pole as indicated, quick-make, quick-break, with trip-free operating handle, position indication and thermal magnetic trip device. Furnish 2 and 3 pole breakers having a common operating handle and common trip mechanism. Furnish breakers

having a minimum interrupting capacity of 10,000 symmetrical amperes at 120 volts AC for single pole breakers and at 240 volts for 2 and 3 pole breakers.

E. Enclosure: NEMA 1, unless otherwise specified as 1A (gasketed) or 12, minimum 20 inch wide box except column type, and with trim having hinged door with flush latch and cylinder lock. Key all locks alike or to the existing master system. Minimum enclosure sizes shall be 20 inches wide x 48 inches high x 5.75 inches deep, except when column type is specified. Furnish cable duct and pullbox with neutral for column mounting panels. Galvanize or phosphatize and prime and finish paint in manufacturer's standard finish, including cable duct and pullbox. Galvanize all recessed boxes.

F. Spaces: When future circuit breakers designated as "space" are noted, or when all specified active, spare and grace positions are accommodated and additional spaces result, equip the panelboard with bus and minimum hardware ready to receive future breakers. Furnish a blank removable spacer plate to cover the "space" until future use.

G. Circuit Directory: Heavy plastic covered metal frame and card on inside of door.

H. Lugs for Mains: Compression type.

I. Manufacturer: Provide one of the following:

1. Schneider Electric/Square D
2. Eaton
3. ABB
4. Siemens

PART 3 - EXECUTION

3.1 GENERAL

A. Assemble and install the panelboards.

B. Mount panelboards at uniform heights throughout the building as indicated, and such that the distance from the floor to the center of the top switch or circuit breaker does not exceed 78 inches. Install handle locking devices on all breakers for night lighting, emergency lighting and similar circuits.

3.2 EQUIPMENT SUPPORTS

A. Mount all electrical equipment, not self supporting, including panelboards securely to walls and columns with 1/4 inch minimum separation from same, and provide all necessary spacers, brackets, structural pieces, inserts, anchors and bolts for this purpose. For equipment fastened to exterior walls below grade, use 1/2” spacers. Provide supports for truss structural pieces, inserts, anchors and bolts for this purpose. Anchor all self-supporting equipment such as distribution panelboards securely to floors and to supporting steel where such supports are indicated or required.

3.3 EQUIPMENT IDENTIFICATION

A. Provide identification on all electrical equipment installed. Refer to Section 260553.

3.4 TOUCH-UP PAINTING

A. On all equipment installed, touch-up paint all manufacturer's standard finished equipment surfaces damaged during construction to "as new" condition with original manufacturer's finish paint.

END OF SECTION 26 2416

SECTION 26 2726 - WIRING DEVICES

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 work of this Section.

B. Related Sections:

1. Section 26 0923 “Lighting Control Devices” for line voltage lighting control devices
2. Section 26 0943 “Performance Based Networked Lighting Controls”

1.2 SUMMARY

A. This Section includes the following:

1. Receptacle services as required, and all materials and equipment, including receptacles, device plates and multi-outlet assemblies, as indicated or specified.
2. Device cover plates including for devices specified in other sections.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data: Submit product data on each item. Coordinate the items, as they relate to the work, prior to submittal. Include the following:

1. All receptacles and clock outlets including device plates.

PART 2 - PRODUCTS

2.1 CONVENIENCE RECEPTACLES

A. 20 Ampere Tamper Resistant Duplex Convenience Receptacles for 120 Volt, Single Phase Service: Two straight blade, 2 pole, 3 wire, NEMA configuration 5-20R receptacles rated 20 amperes, 125 volts, NEMA performance standard, specification grade, for back and side wiring, brown color.

1. Manufacturer: Provide one of the following:

a. Arrow-Hart
b. Bryant
c. Hubbell
d. Pass & Seymour

B. 20 Ampere Tamper Resistant Duplex Ground Fault Circuit Interrupter (GFCI) Convenience Receptacles for 120 Volt, Single Phase Service: Two straight blade, 2 pole, 3 wire grounding, NEMA configuration 5-20R receptacles rated 20 amperes, 125 volts, NEMA performance standard, specification grade, with provisions for back and side wiring, brown color.

1. Units shall have a test and reset button on the face of the receptacles and visible indication of a tripped condition.

2. Manufacturer: Provide one of the following:

   a. Arrow-Hart
   b. Bryant
   c. Hubbell
   d. Pass & Seymour

2.2 DEVICE PLATES

A. Device Plates in Offices and Other Finished Areas: Stainless steel No. 302 finish.

B. Screws: Provide screws having a finish matching the plate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount equipment at locations indicated.

B. Install devices in outlet boxes as specified in Section 26 0533 "Raceways and Boxes for Electrical Systems" unless otherwise specified in this Section. Mount devices at uniform heights above the floor for various areas as indicated.

C. Install plates on flush mounted devices with all four edges in continuous contact with finished wall surfaces without the use of plaster mats or similar devices. Do not use plaster or similar fillings. Install plates vertically, unless otherwise noted, with an alignment tolerance of 1/16 inch.

END OF SECTION 26 2726

SECTION 26 2913 - ENCLOSED CONTROLLERS

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 work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Motor control as required, and all material and equipment, including:

a. Control devices.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.

B. Submit shop drawings and product data on the following:

1. Single phase manual motor starters fractional horsepower type.

PART 2 - PRODUCTS

2.1 SINGLE PHASE MANUAL MOTOR STARTERS FRACTIONAL HORSEPOWER TYPE

A. Single-Speed Starters for 115 Volt Motors: Per NEMA Standard ICS and consisting of a toggle-operated, or key-operated when indicated, single pole, quick-make, quick-break type starter, one thermal overload element, and pilot lights in cover when indicated all mounted in a NEMA 1 surface mounting enclosure, or with a stainless steel plate for flush mounting in an outlet box, as indicated. Provide means for padlocking the toggle operator in the "off" position. Provide a total of four keys for operation of key-operated starters.

B. Single-Speed Starters for 230 Volt Motors: Per NEMA Standard ICS and consisting of a toggle-operated, or key-operated when indicated, two pole quick-make, quick-break type starter, one thermal overload in each phase, and pilot lights when indicated, with similar features to those specified for starters for 115 volt motors.

C. Manufacturer: Provide one of the following:

1. Schneider Electric/Square D
2. Eaton
3. ABB
4. Siemens

PART 3 - EXECUTION

3.1 INSTALLATION

A. Motors: Refer to Section 26 0500 “Common Work Results for Electrical" for furnishing and mounting responsibility for all electric motors. Motors 1/2 horsepower and larger are 460 volts, 3 phase, 60 hertz, and motors less than 1/2 horsepower are 115 volts, single phase, 60 hertz, unless other requirements are indicated. In all cases where the capacity or rating of equipment being furnished under this Section is based on the rating of equipment being furnished under other Sections, confirm such ratings before purchasing the equipment.

END OF SECTION 26 2913

SECTION 26 5119 - LED INTERIOR LIGHTING

PART 1 - PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Materials.
3. Finishes.
4. Lighting fixture supports.

B. Related Requirements:

1. Section 26 0529 “Hangers and Supports for Electrical Systems.”
2. Section 26 0553 “Identification for Electrical Systems.”
3. Section 26 0923 “Lighting Control Devices.”

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

H. L70: Point in time where light fixture output is 70% of initial light output.

I. MacAdam Ellipse: Color consistency of LEDs from chip to chip.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture indicated.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, finishes and listings.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (delivered lumens, CCT, and CRI), and energy efficiency data.
6. Provide finish samples for all finishes specified with custom or non-standard colors.
7. Photometric data, including IES file, and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The

adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project, IES LM-79 and IES LM-80.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

8. LED drivers. Original manufacturer's cut sheet for specific driver used for each lighting fixture type.

B. Shop Drawings: For custom luminaires.

1. Include plans, elevations, sections and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of luminaire.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency or by a qualified testing agency.

E. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. A complete submittal package of all lighting products provided as part of this project. This includes, but is not limited to, lighting fixtures and all installed components (drivers, emergency battery packs, etc.).

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. 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, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be within a three-step MacAdam Ellipse centered on the black body curve to ensure color consistency among luminaires.

E. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Manufacturer and installer agree to provide and install replacement fixtures for any components or fixtures (drivers, LED modules, etc.) that fail prior to Substantial Completion and project commissioning.

B. Warranty: Manufacturer and Installer agree to repair or replace components, including driver/power supplies and thermal management, of luminaires that fail in materials or workmanship within specified warranty period.

C. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Recessed Fixtures: Comply with NEMA LE 4.

C. CRI of minimum 80. CCT of 3500K or as indicated in the Lighting Fixture Schedule.

D. Lamps dimmable from 100 percent to 0 percent of maximum light output or as indicated in the Lighting Fixture Schedule.

E. Internal Driver: Driver shall be individually fused with fuses accessible from outside of the fixture chassis.

F. LED (Light Engine): Complies with IEC and FCC Standards with ratings and compliances as stated below, or as indicated in Lighting Fixture Schedule.

1. LED Color Temperature: 3500°K.
2. Minimum rated lifetime of L70 @ 50,000 hours based on IES LM-80 testing.
3. Operating Temperature: -40°C to +50°C (-40°F to 122°F).
4. Operating Hours: Designed for 60,000+ hours of maintenance free operation.
5. Warranty: Minimum 5-year warranty. If 15% or more of light emitting diodes fail to illuminate within the 5-year warranty period the manufacturer shall replace the light fixture. 5-year no color shift warranty.
6. IP66 rated.
7. Tested in compliance with IES LM-79, LM-80 and TM-21.
8. Minimum ETL listed.

G. Driver: Complies with IEC and FCC standards with ratings and compliances as stated below, or as indicated in Lighting Fixture Schedule.

1. Driver: Components are fully encased in potting material for moisture resistance.
2. Operating Temperature: -40°C to +50°C (-40°F to 122°F).
3. Operating Hours: Designed for 60,000+ hours of maintenance free operation.
4. Provides transient voltage protection in accordance with IEEE/ANSI C62.41.2 guidelines.

5. Warranty: 5-year warranty.
6. Minimum ETL listed.

2.2 FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.3 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 0529 "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 luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

F. All fixture support hardware shall be finished to match luminaire in finished spaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls, and secure according to manufacturer’s written instructions and approved submittal materials, unless otherwise indicated. There shall be no gaps between adjacent fixtures or between luminaires and surrounding surfaces. Lenses, reflectors and trims of luminaires shall be properly and uniformly aligned.

C. Supports:

1. Sized and rated for luminaire weight.
2. Provide support for luminaire without causing deflection of ceiling or wall.
3. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

D. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

E. Suspended Luminaire Support:

1. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation and that luminaires are switched according to the Drawings.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
3. A visual inspection shall be performed to verify cleanliness and alignment of the fixtures. Misalignment and light leaks shall be corrected and rattles due to ventilation system vibration shall be eliminated.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 26 5119

SECTION 28 3111 - FIRE ALARM SYSTEM - ADDRESSABLE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Specification provides the requirements for the installation of a complete point-addressable type manual and automatic fire detection system network tied to existing fire alarm system. The system shall include but not be limited to: alarm initiating and indicating peripheral devices, conduit, wire and accessories required to finish connect to existing fire alarm system.

B. The system specified herein will provide emergency/voice alarm notification throughout the renovated space.

C. The completed system shall be certified on State Fire Marshal Form FM-12A in accordance with Public Act 144.

1.3 FIRE ALARM AND PROTECTIVE SYSTEM SEQUENCE OF OPERATION

A. The operation of a manual station or any automatic alarm initiation device shall automatically:

1. Sound all alarm signals (Code 3) throughout the building.
2. Flash all alarm lights/strobe throughout the building. Silencing the devices (audible circuit) shall not automatically turn off flashing alarm lamp/strobes.
3. Operate prioritized outputs to release all smoke doors and magnetically locked doors throughout the building.
4. Initiate the transmission of an alarm to central stations selected by the Owner or his representative. This selection, its fees and fees for any telephone lines are the sole responsibility of the Owner or his representative.
5. Visually indicate via the control panel LCD or an alarm LED, the addressable device of the circuit of alarm initiation. When the control panel goes into the alarm condition the (GREEN) NORMAL LED shall extinguish and the (RED) ALARM LED shall light, the BUZZER shall pulsate and the first line of the 80 character LCD shall indicate the REAL TIME, the number of MESSAGES WAITING< the TYPE OF ALARM, the ALARM ZONE NUMBER, and the TIME THAT THE ALARM OCCURRED>. The second line shall display the user specified message. In order to reduce false alarms, all inputs shall be capable of alarm verification. The system shall be capable of setting the sensitivity of all analog sensors by point and be capable of displaying the analog value of the sensor by device and/or traditional input and vectoring the value to the printer. The system shall automatically identify any analog sensor which becomes dirty (maintenance alert) prior to false alarming.
6. Upon operation of the associated duct smoke detector, the air handling systems shall be deactivated so as to prevent the recirculation of smoke. Such actions shall override the regular mechanical systems controls.
7. A break in the initiating loop wiring shall light both the common trouble lamp and the respective zone trouble lamp on the control unit, as well as sound a trouble signal at the fire alarm control panel.
8. A break in the indicating loop wiring shall light the common trouble LED and "Indicating Loop Trouble" LED on the fire alarm control unit, as well as sound a trouble signal at the fire alarm control unit.

B. The operator shall acknowledge the alarm by pressing the acknowledge button, and the buzzer will silence providing there is not an additional alarm pending. If there are additional alarms waiting, the operator shall acknowledge all pending alarms before the buzzer will silence. To silence audible devices, the operator shall press the ALARM SILENCE button, a new alarm shall cause the audibles to resound. To reset the system, the operator shall press the RESET button.

1.4 STANDARDS

A. The equipment and install shall comply with the current provisions of the following standard:

1. National Electric Code, Article 760 and applicable standards of NFPA 90A including (not an inclusive list):

   a. NFPA 72A National Fire Alarm Code.
   b. NFPA 101 Life Safety Code.

2. Local and State building codes.
3. Local authorities having jurisdiction: ULC, CSFM, BSA, State Fire Marshal.
4. Underwriters' Laboratories, Inc.

B. The system and all components shall be listed by Underwriters' Laboratories, Inc. for use in fire protective signaling system under the following standards as applicable:

1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems".
2. UL 217, "Single and Multiple Station Smoke Detectors".
3. UL 268, "Smoke Detectors for Fire Protective Signaling Systems".
4. UL 268A, "Smoke Detectors for Duct Applications".
5. UL 464, "Audible Signal Appliances".
6. UL 521, "Heat Detectors for Fire Protective Signaling Systems".
7. UL 864, "Control Units for Fire Protective Signaling Systems"
8. UL 1480, "Speakers for Fire Protective Signaling Systems".
9. UL 1971, "Signaling Devices for the Hearing Impaired".

1.5 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

1. Shop Drawings: Submit detailed point-to-point wiring diagrams and installation instructions. Shop drawings show color coding of connections and mounting dimensions of equipment.
2. Product Data: Submit product data for each fire alarm system component specified.

B. A complete set of shop drawings shall be submitted to the State of Michigan (SOM) Office of Fire Safety for approval in accordance with Act 144 of 1982. Shop drawings shall be approved by the SOM and all SOM comments reflected on the documents prior to submission of the shop drawings to the Engineer for approval. Shop drawings submitted to the Engineer prior to SOM approval will be returned - rejected.

C. The Contractor shall submit complete sets of documentation within 30 calendar days after award of purchase order. Indicate the type, size, rating, style, catalog number, manufacturers' names, photos, and/or catalog data sheets for all items to ensure compliance with these Specifications. This equipment shall be subject to his approval and no equipment shall be ordered without this approval. Equipment devices are shown on the Contract Drawings, provide shop drawings as follows:

1. Complete one-line riser diagram showing all equipment and the size, type and number of all conductors.
2. Drawing of typically multiplexed field panel.
3. Provide calculations to support the size of standby batteries submitted.
4. Include programming and installation manuals.

D. At Contract close-out deliver six (6) copies of the following to the Owner's Representative within thirty (30) days of date of system acceptance:

1. Installation and programming manuals covering the installed system.
2. Point-to-point diagrams of the entire system as installed. Number all conductors and show all terminations and splices.
3. The application program listing for the system is installed at the time of acceptance.
4. Name, address, and telephone number of the authorized factory representative.

1.6 WARRANTY

A. Warranty all materials, installation and workmanship for one (1) year from date of acceptance, unless otherwise specified.

1.7 MAINTENANCE

A. Maintenance and Service Contract: Submit a maintenance and service contract with service rates covering all labor and materials necessary to repair damage to the system. The service contract shall include a differentiation between and definitions of "emergency" and "non-emergency" service with applicable rates for each.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Provide products by one of the following:

1. National Time & Signal

2.2 STROBES

A. Strobes shall be rated 15, 30, 60, 75, 110 or 177 candela as shown for proper illuminance, with a 1 Hertz flash rate, Xenon flash tube, white body, clear Lexan lens with red "FIRE" or international fire symbol lettering, capable of being synchronized, and capable of wall or ceiling mounting.

2.3 COMBINATION HORN/STROBES AND SPEAKER/STROBES

A. Combination horn/strobes and speaker/strobes shall consist of the horns, speakers and strobes specified above but combined on a single mounting plate. Combination units used outdoors and in wet areas shall be waterproof and mounted to waterproof back boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The system shall be installed with dedicated conduits or surface wiremold, conductors, outlet boxes, fittings, connectors and accessories necessary to ensure a complete, operable system in compliance with all applicable codes and regulations.

B. Install all equipment at locations indicated, and secure to ceilings, walls, floors or structural members as required.

C. Provide final wiring and connections via the manufacturer's wiring diagrams. Wiring for the fire alarm system shall be in separate conduits from any other system.

D. Outlet, pull and junction boxes shall be installed in accordance with Section 26 0533.

E. All fire alarm system conduits and outlet boxes shall be marked and labeled.

F. T-tapped connections will not be allowed on any supervised circuits. The connections shall be directly to and from device terminal screws. Screw terminal shall have rising plates to terminate more than one wire or each wire shall be terminated to individual screws or each wire shall terminate in a ring lug.

1. Notification appliance circuits (NAC) shall be Class B.
2. Communication (initiating) circuits shall be Class A.

G. The location of smoke detectors in air ducts shall be as required by code and shall be accessible for maintenance. Duct smoke detectors shall be hard wired to shutdown associated air handlers.

H. Provide as-built wiring diagrams at completion of Project.

3.2 IDENTIFICATION

A. All junction box covers, conduct couplings and panels shall be painted red to match system manufacturer's hue.

B. Label all control and monitor modules and detectors with point numbers and function.

3.3 FIELD QUALITY CONTROL

A. Adjusting: After completion of system wiring, connect, test, adjust, and readjust as necessary, all equipment in terms of design function and performance.

1. Provide equipment to check the calibration of instruments. Instruments, not in calibration, shall be recalibrated to function as required, or shall be replaced.
2. Calibrate and adjust devices, linkages, accessories, and components for stable and accurate operation to meet the design intent and to obtain optimum performance from the equipment. Final adjustment, calibration and checking shall be performed while the system is in full operation. Cause every device to automatically function as intended to ensure its proper operation.

B. Demonstration: After calibration, adjustment, and checking have been completed and system is operational, demonstrate to the governing authorities having jurisdiction and to the Architect-Engineer the complete and correct functioning of all system components and equipment. These demonstrations shall consist of operating the controls through their normal full ranges and sequences. Simulate abnormal conditions to demonstrate proper functioning of the devices. Readjust settings to their correct design values and after sufficient time, observe ability of controls to establish the desired conditions, noting abnormal deviations. Make necessary repairs, replacements or adjustments on items which fail to perform satisfactorily and repeat tests to demonstrate compliance with the design intent.

1. When the system is in specified operational condition, and when pertinent operational functions have been demonstrated, system will be accepted.

END OF SECTION 28 3111

SECTION 31 2000 – EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Subbase course for concrete pavements and slabs-on-grade.

1.3 DEFINITIONS

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

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

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

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

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

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

1. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

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

G. MDOT: Michigan Department of Transportation.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment without systematic drilling, ram hammering, ripping, or blasting, when permitted:

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

J. Subbase Course: Aggregate layer placed between the subgrade and slabs-on-grade.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

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

1.4 PREINSTALLATION MEETINGS

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

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

a. Personnel and equipment needed to make progress and avoid delays.
b. Coordination of Work with utility locator service.
c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
d. Extent of trenching by hand or with air spade.
e. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Warning tapes.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.

1.7 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

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

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.

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

D. Backfill and Fill: Satisfactory soil materials.

E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

1. Generally either an MDOT Class II sand or 21AA gravel will meet this requirement.

G. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

1. Generally either an MDOT Class II sand or 21AA gravel will meet this requirement.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

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

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

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

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. 6 inches beneath bottom of concrete slabs-on-grade.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.6 SUBGRADE INSPECTION

A. Notify Architect and Testing Agency when excavations have reached required subgrade.

B. If Architect or the Testing Agency determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade in the presence of the Testing Agency to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction repeating proof-rolling in direction perpendicular to the first direction.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Testing Agency, and replace with engineered fill as directed

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

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect at no additional cost to the Owner.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.8 STORAGE OF SOIL MATERIALS

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

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

3.9 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

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

3.10 SUBBASE COURSE UNDER CONCRETE SLABS-ON-GRADE

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

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

1. Place subbase course 6 inches or less in compacted thickness in a single layer.
2. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
3. Compact each layer of subbase course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.11 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.

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

3.12 PROTECTION

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

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

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before date of Substantial Completion, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

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

3.13 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 2000