WAYNE RESA

BUILDING AUTOMATION SYSTEM INTEGRATION
33500 VAN BORN ROAD
WAYNE, MICHIGAN

Project Manual

IDS Project No. 20235-1000

May 14, 2021
Bids

Project Manual

Wayne RESA
Building Automation System Integration
Wayne, Michigan

INTEGRATED design SOLUTIONS
architecture engineering interiors & technology

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IDS Project No. 20235-1000

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DIVISION 25 – INTEGRATED AUTOMATION

Not Applicable

DIVISION 26 - ELECTRICAL

DIVISIONS 27 AND 28

Not Applicable

SITE AND INFRASTRUCTURE SUBGROUP

DIVISIONS 31 THRU 33

Not Applicable

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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 Performed by Owner.
3. Owner-furnished/Contractor-installed (OFCI) products.
4. Owner-furnished/Owner-installed (OFOI) products.
5. Contractor's use of site and premises.
6. Coordination with occupants
7. Work restrictions.
8. Specification and Drawing conventions.

1.3 PROJECT INFORMATION

A. Project Identification: Wayne RESA, Building Automation System Integrations.

1. Education Center
   33500 Van Born Road,
   Wayne, Michigan
2. Burger Baylor
   28865 Carlysle Street
   Inkster, MI 48141

B. Owner: Wayne RESA, 33500 Van Born Road, Wayne, Michigan 48178.

C. Architect/Engineer: Integrated Design Solutions, 1441 West Long Lake Road, Suite 200, Troy, Michigan 48098.

1.4 WORK PERFORMED BY OWNER (If any)

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.

1.5 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS (If any)

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: (If any)

1. As indicated on Drawings and in Specification Sections.

1.6 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS (If any)

A. The Owner will furnish and install products indicated.

B. Owner-Furnished/Owner-Installed (OFOI) Products: (If any)

1. As indicated on Drawings and in Specification Sections.

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

D. 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.

1.8 COORDINATION WITH OCCUPANTS

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

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

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 or required by Owner. 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; subject to Owner approval.

C. 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 for temporary utility services according to requirements indicated:

1. Notify Architect, Construction Manager, and Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

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

1. Notify Architect, Construction Manager, and Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. 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.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

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.

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 01 3300 "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 01 7300 - 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: Provide one of the following, or a similar form:

a. CSI Form 1.5C during bidding phase.
b. 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. Progress cleaning.
5. Starting and adjusting.
6. 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 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.

1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect and Construction Manager of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:

    a. Contractor's superintendent.
    b. Trade supervisor responsible for cutting operations.
    c. Trade supervisor(s) responsible for patching of each type of substrate.
    d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.

2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 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.

1.6 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. Conveying systems.
k. Electrical wiring systems.
l. Operating systems of special construction.

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

a. Water, moisture, or vapor barriers.
b. Membranes and flashings.
c. Exterior curtain-wall construction.
d. Sprayed fire-resistive material.
e. Equipment supports.
f. Piping, ductwork, vessels, and equipment.
g. Noise- and vibration-control elements and systems.

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

1.7 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 [(Not Used)]

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

B. 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.

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 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. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 01 1000 "Summary."

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

F. 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.

G. 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.

H. 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 and Owner-furnished, Owner-installed products

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. Comply with waste disposal requirements in Division 01.

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. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01.

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

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

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

E. Manufacturer's Field Service: Comply with qualification requirements in 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. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

D. 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 01 7900 "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 in accordance with Division 01.
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. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

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

D. 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.

E. 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.

F. 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.

C. Construction Waste Disposal: Comply with waste-disposal requirements in Division 01.

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 01 7700 "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 01 4000 "Quality Requirements," experienced in operation and maintenance procedures and training.

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

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 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 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.

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-self-contained” equipment is specified, only one power supply shall be provided to that equipment as a part of the Work under Division 26 Sections, except as otherwise modified or supplemented by the Contract Documents for that item. All other electrical equipment including starters and wiring is part of the Work in Division 26 Sections.

I. 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.

J. 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.

K. 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.

B. Acceptance of Conditions: Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
4. 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. New equipment installed shall not be used for temporary construction use without prior written approval from Owner's representative.

3.2 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.

3.3 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.

3.4 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.

3.5 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.

3.6 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 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: Mechanical Systems Requirements
2. Division 23: Heating, Ventilating and Air-Conditioning (HVAC)
3. Division 26: Electrical

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 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, electrical, and accessories as indicated and as necessary for a complete controls solution.
2. The MSCC shall provide a fully integrated software based BAS Operator Interface System (OIS) for the remote monitoring and control of the BAS including but not limited to BAS system point monitoring, developed system graphics, point trends, equipment schedules, and system alarm annunciation. Systems Integration work regarding the BAS Operator Interface System shall be completed by the MSCC.
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.
4. The MSCC shall complete integration of auxiliary systems (ie. Emergency Power Monitoring, Fire Alarm Systems, Temperature & Flood Monitoring Systems, etc.) into the central OISm as indicated in the project Drawings and Specifications. MSCC shall review project Drawings and Specifications as necessary for any requirements and details regarding auxiliary systems integration.

1.3 DEFINITIONS

A. AE: Architect/Engineer

B. BACnet: Communications Protocol for Building Automation and Control Networks

C. BAS: Building Automation System

D. BMS: Building Management System

E. BTL: BACnet Testing Laboratories

F. B-AWS: BACnet Advanced Operator Workstation

G. B-OWS: BACnet Operator Workstation

H. B-OD: BACnet Operator Display

I. B-BC: BACnet Building Controller

J. B-AAC: BACnet Advanced Application Controller

K. B-ASC: BACnet Application Specific Controller

L. B-LD: BACnet Lighting Device

M. B-SS: BACnet Smart Sensor

N. B-SA: BACnet Smart Actuator

O. B-RTR: BACnet Router

P. B-GW: BACnet Gateway

Q. B-BBMD: BACnet Broadcast Management Device

R. B-GEN: BACnet General

S. DDC: Direct Digital Control

T. EPROM: Erasable Programmable Read-Only Memory

U. EEPROM: Electronically Erasable Programmable Read-Only Memory

V. IP: Internet Protocol

W. IT: Information Technology

X. LAN: Local Area Network

Y. LCC: Laboratory Controls Contractor

Z. MSCC: Mechanical Systems Controls Contractor

AA. MSTP: Master/Slave Token Passing

BB. OIS: Operator Interface System

CC. PICS: BACnet Protocol Implementation Conformance Statement

DD. SI: Systems Integrator

EE. UC: Unitary Controller

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 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 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, electrical 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 circuits within the nearest available electric distribution panel.
    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 a BTL Certified BAS front end Operator Interface System connected to all new controllers and control devices as indicated.

1. Operator Interface system software shall be web based and shall include but not limited to developed system graphics with live DDC point data, system point trend view and configuration, equipment schedule configuration and management, and system alarm configuration and annunciation.
2. Owner shall provide a virtual server to host Operator Interface system software. Server shall be selected and sized to facilitate Operator Interface system requirements, including trend data and

system activity log storage. MSCC shall coordinate server requirements and all software installation with the Owner as necessary.

3. Furnish and install all software, programming and database required for complete Building Automation System and Direct Digital Control functions to monitor and control points as specified.
4. The system shall not be limited to only standard communication protocols but shall also be able to integrate to a wide variety of third-party devices and applications via drivers and gateways.
5. Operator Interface system shall be selected and sized to meet current project requirements, to facilitate BAS requirements of subsequent project phases, and to facilitate intended future system expansion. Review and confirm expectations and requirements for future system expansion with the Owner and the project AE.
6. Operator Interface system software shall be selected and configured to enable access and utilization via any computer on the Owner's IP network.
7. Operator Interface and BAS system architecture and equipment shall be configured and selected in coordination with the Owner's IT representatives for compliance and compatibility with all site IT requirements.

E. Provide on-site supervision, calibration and checkout of the control systems.

F. 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.

G. Provide shop drawings as specified herein.

H. Provide guarantee as specified herein.

I. 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. Trunk cable schematic showing programmable control unit locations and trunk data conductors.
6. Listing of connected data points, including connected control unit and input device. Input/output point summary with recommended set points.
7. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
8. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
9. Bill of materials to identify each control device.
10. 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).
11. 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. Maintenance Data: For equipment to include in the maintenance manuals specified in Division 01.

E. Warranties: Special warranties specified in this Section.

F. No work shall be executed until the final submittals are approved by the project AE.

G. 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 connections and integration to existing site Automatic Transfer Switch (ATS) with unit manufacturer/service team if necessary to complete required scope and to retain all existing system functionality. Any required support from Asco shall be included in the project bid. Asco contact: Chris Ettinger, (248) 376-8356, christopher.ettinger@ascopower.com.

C. Coordinate connections and integration to existing site Uniterruptible Power Supply (UPS) with unit manufacturer/service team if necessary to complete required scope and to retain all existing system functionality. Any required support from Eaton/RC Merchant & Co. shall be included in the project bid. Eaton contact: David MacKinnon/ RC Merchant & Co., (248) 476-4600.

D. Coordinate connections and integration to existing Fire Alarm devices with Fire Alarm Service Team (FAST). FAST support shall be included in the project bid. FAST contact: Laura Jonik, (248) 534-0701, lauraj@fastofmi.com.

E. Coordinate locations and requirements for IT Data connections with the Electrical/Technology Contractor.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced and certified installer of the automatic control system manufacturer for both installation and maintenance of units required for this Project, including a minimum of 5 years of documented experience with projects of similar scope and complexity. An experienced Tridium Niagara N4 Master Systems Integrator including a minimum of 5 years of documented experience, and a minimum of two (2) Niagara N4 certified technicians. An experienced and certified installer and integrator of Circon BAS systems with documented experience integrating existing Circon Systems on LonIP/TP-1250/FT-10 networks with LNS to Niagara OIS systems, including references.

B. Manufacturer Qualifications: A company experienced in manufacturing automatic temperature-control systems similar to 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.

1.8 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.

1.9 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 any and 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. Distech (non-proprietary)
2. Johnson Controls Facility Explorer (non-proprietary)

B. Provide a BAS Operator Interface system that is BTL Certified as a BACnet Advanced Operator Workstation (B-AWS) by Tridium (Niagara 4). Provided system shall include Niagara Workbench engineering software, to be installed on the central system virtual server.

C. Provided JACE controllers shall be fully open, non-proprietary Niagara N4 devices by Vykon.

D. The MSCC shall be responsible for the complete installation of the system with full responsibility for proper operation including design, installation, checkout, testing, commissioning and warranty as herein described.

2.2 GENERAL

A. The MSCC shall provide a complete mechanical controls system including but not limited to programming, DDC controllers, software, sensors, transmitters, power supplies and wiring, network, gateways, routers, and all other devices required for a complete system.

B. The MSCC shall provide a software based BAS Operator Interface system 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.

C. 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 Operator Interface system server via the Owner's IP network.

D. 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.

E. 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.

F. Systems requiring multiple controllers (ie. large chilled water plants) shall not utilize the Owner IP network for communication between common system controllers.

G. 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).

H. 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.

2.3 OPERATOR INTERFACE SYSTEM

A. General

1. The MSCC shall provide a BTL Listed Operator Interface System for central, remote management and monitoring of connected BAS devices. This software system shall be installed on a server, and connected to specified Facilities devices via the Owner IP network. The Operator Interface system shall be accessible via any authorized computer on the Owner IP network.
2. The 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. System Software

1. The MSCC shall provide an Operator Interface System that is BTL Listed as a BACnet Advanced Operator Workstation (B-AWS).
2. In addition to BACnet, the system shall also be capable of integrating to a wide variety of devices utilizing common industry protocols including Modbus and Lon, as well as a wide variety of other device protocols such as OPC, SNMP, etc., via drivers and gateways.
3. System shall include accessibility over the Owner IP network, and remotely over the Internet including required Owner IT network security measures.
4. System shall include a thin-client web browser Graphical User Interface (GUI) that is browser and operating system agnostic. At a minimum, thin-client shall be accessible via Microsoft, Firefox, and

Google Chrome (current versions) web browsers without requiring local machine installations of proprietary software, programs, plug-ins, etc.

5. The system shall include system graphics utilities for displaying live system BAS point values overlaid on system diagrams generated fully within the OIS utilities. Scanned project documents shall not be used as graphical backgrounds.
6. System shall include system point trend configuration and viewing utilities. Trend viewer shall include graphical line graph and tabular point trend viewing and shall be able to export system trend data via .csv file exports.
7. System shall include alarm configuration and management utilities.

    a. System shall include an active alarm list, displaying all currently active alarms within the connected system. Alarm list shall automatically refresh and shall include alarm prioritization and system operator tools for alarm acknowledgement and handling.
    b. System shall include options for remote alarm annunciation via email and SMS text.

8. System shall include Equipment Operational Schedule configuration and management including graphical visualization of set operational time periods.
9. System shall require user account and password for system access and shall include detailed options for assignment of permissions to various levels of system operation (alarm management, point commanding, system configuration, etc.) and to specific connected devices. System shall support utilization of Owner's central Active Directory or other user account directory system for system user account management.
10. System shall be selected, sized, and provided with all necessary licenses and options to support at least 10 concurrent system users.
11. System shall be selected, sized, and provided with all necessary licenses and options to support integration of all points associated with the work scope detailed within project Drawings and Specifications, including indicated plans for future system expansion, and including at least 20% additional point capacity space.
12. System shall include available system storage to retain at least 2 full years of system point trend data, and system activity log data.
13. System shall be selected and sized to meet the following minimum performance requirements:

    a. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
    b. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 5 seconds.
    c. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
    d. Object Scan: Transmit change of state and change of analog values to control units or workstation within 5 seconds.
    e. Alarm Response Time: Annunciate alarm at workstation within 10 seconds. Multiple workstations must receive alarms within 5 seconds of each other.
    f. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

        1) Water Temperature: Plus or minus 1 deg F.
        2) Water Flow: Plus or minus 5 percent of full scale.
        3) Water Pressure: Plus or minus 2 percent of full scale.
        4) Space Temperature: Plus or minus 1 deg F.
        5) Ducted Air Temperature: Plus or minus 1 deg F.
        6) Outside Air Temperature: Plus or minus 2 deg F.
        7) Dew Point Temperature: Plus or minus 2 deg F.
        8) Relative Humidity: Plus or minus 5 percent.
        9) Airflow: Plus or minus 5 percent of full scale.
        10) Air Pressure (Space): Plus or minus 0.01-inch WC.
        11) Air Pressure (Ducts): Plus or minus 0.1-inch WC.
        12) Carbon Monoxide: Plus or minus 5 percent of reading.
        13) Carbon Dioxide: Plus or minus 50 ppm.
        14) Electrical: Plus or minus 5 percent of reading.

14. The system shall be provided including all licenses, permissions, and accessories to enable full system access and ownership by the Owner. The owner shall receive all system Administrator level logins and passwords and shall have full licensing and access rights for all network management, operating system server, engineering, and programming software required for the ongoing maintenance and operation of the system.

C. Systems Integration: The MSCC shall complete integration of all devices indicated in the project Drawings and Specifications for integration into the common central Operator Interface System, including but not limited to Mechanical Systems Controls, Emergency Power Monitoring, Fire Alarm System, and auxiliary systems.

1. Points: Available points from connected field devices shall be integrated into the central Operator Interface System 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 Operator Interface System.
   b. Homepage for each building including building photograph and click button links to all connected central building equipment equipment, or equipment summary pages, and links to building floorplan graphics.
   c. Graphics shall include uploaded building keyplan style floorplans for all building floors including room numbers. Floorplan graphics shall include key information (ie. 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 Operator Interface System 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 status and alarm states. Coloration shall be variable for each class of points, as chosen by the Owner.
   j. 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 & 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 Operator Interface System 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 Operator Interface System 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 & binary I/O's.

7. 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 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 85 degF, plus or minus 0.5 degF, 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, or 30 to 250 degF for heating applications
g. Outside Air (OA) temperature with a range of minus 40 to plus 130 degF, plus or minus 2 degF
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.

B. Humidity Sensors

1. Humidity sensor shall use a thin film capacitive sensing element to measure the relative humidity (RH) over a range of 0% to 100% RH. Accuracy shall be +/-2% RH.
2. Humidity transmitters shall be suitable for one or more of the following mounting methods:

a. Room Type: Shall be suitable for wall mounting with enclosure where located in a finished space.
b. Insertion Type: Shall be suitable for insertion into air ducts at any angle, and shall have a minimum insertion of 6 inches.

2.6 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 $\pm$ 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 equipment manufacturer's recommendation and requirements of the mechanical control systems.

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 INSTALLATION

A. Install equipment level and plumb.

B. Install software in control units and Operator Interface System. 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.

3.3 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.

3.4 CONNECTIONS

A. 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.

3.5 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.

3.6 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.

3.7 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.

3.8 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.

3.9 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.

3.10 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.

B. Provide 40 hours of additional system graphics development and system customization beyond the requirements of the drawings and specifications at the Owner’s direction.

3.11 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 40 hours of “classroom” instruction to the client’s personnel on the operation of the Operator Interface System, and the associated system engineering software. The curriculum shall include:

1. System overview
2. System software and operation
3. System access
4. Software features overview
5. System network communication overview
6. Changing set-points and other attributes
7. Scheduling
8. Editing programmed variables
9. Creating, modifying, and displaying color graphics
10. Running reports
11. Workstation maintenance
12. Viewing application programming

END OF SECTION 23 0900

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 that apply to the electrical work
6. Permits, fees and inspections
7. Changes involving Electrical Work
8. Submittals
9. Project record documents
10. Operation and maintenance manuals and equipment
11. Delivery, storage and handling
12. Warranty
13. Description of electrical systems
14. Scope of work specified in Division 26
15. Related work specified in other Divisions
16. Systems provided by the 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. Cutting and patching
    b. Excavation and backfill
    c. Equipment supports
    d. Coordination with other trades
    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 - American Society for Testing Materials
5. BICSI - Building Industry Consulting Service International
6. FCC - Federal Communication 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 Hazard Association
12. NEC - National Electrical Code
13. NETA – International Electrical Testing Association
14. NEMA - National Electrical Manufacturer's Association
15. NFPA - National Fire Protection Association
16. OSHA – Occupational Safety and Health Act
17. UL - 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 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. Ordinances, Codes and Standards: 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 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: All materials and installations shall comply with the requirements of the State of Michigan Handicapped Barrier-Free Regulations and with the Americans with Disabilities Act (ADA).

D. Rules of Local Utility Companies:

1. Perform work in accordance with the rules of local utility companies. Before submitting the bid check with each utility supplying service to this Project. Determine from them all equipment and charges which they will require and include the cost in the bid.

E. 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.

F. Sequencing and Scheduling: Sequence and schedule work so as 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 Bids, examine the site, architectural, mechanical and other trades' drawings and specifications.

1. Notify Architect/Engineer should any discrepancies occur between them 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 trade's documents or required due to existing conditions.
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.

1.6 SUBSTITUTIONS

A. Base Bid shall be in accordance with materials or products specified. Any exceptions to this shall be approved in writing by the Architect/Engineer ten (10) days or more prior to bidding.

1.7 ALTERNATES

A. Mandatory Alternates:

1. The Contractor shall refer to Alternates listed in Division 01 and Proposals and shall submit price quotations for the alternates that apply to the electrical work.

B. Voluntary Alternates:

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.

1.8 PERMITS, FEES AND INSPECTIONS

A. Obtain all permits, licenses, inspections and test required. Upon 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 Certificate of Electrical Inspection shall be provided as a requirement prior to final payment.

1.9 CHANGES INVOLVING ELECTRICAL WORK

A. The design of the electrical systems is based on the mechanical and building equipment specified and scheduled on the Drawings.

1. Where equipment changes are made that involve additional electrical work (increased motor horsepower or increased unit full load amperes, requirements for a disconnect switch scheduled to be part of the equipment, requirements for a starter scheduled to be part of the equipment, additional wiring of equipment, etc.) the Mechanical or respective trades involved shall compensate the electrical trades for the cost of the additional work required.

1.10 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, equipment, and their manufacturers, for approval by the Architect/Engineer within 15 days after award of contract and prior to submittal of shop drawings.

C. Provide equipment submittals in the form of letters of intent, product data catalog sheets or shop drawings as hereinafter specified for all materials provided on the project.

D. 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 Contractor’s 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.

E. 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.

F. Partial submittals for equipment shall not be permitted. Where partial submittals are transmitted to the Architect/Engineer, they will be returned "Rejected”.

G. Where the equipment submittals 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".

H. 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.

I. 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, the name of the selected manufacturer and the catalog number of the product. The aforementioned information shall be typed on the Electrical Contractor's letterhead and submitted with one (1) product data sheet for each product itemized in the Letter of Intent for record.

J. Shop Drawings: Prepare layout shop drawings drawn to scale in electronic format and submit one (1) transparency copy and two (2) prints of each to the Architect/Engineer for review, together with required number of additional copies as required by the General Conditions. After the shop drawings are reviewed, the transparency copy will be stamped and returned for printing and distribution. 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.

K. No apparatus or equipment shall be shipped from stock or fabricated until equipment submittals for them have been reviewed and approved 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 Electrical Trades of full responsibility for the proper and correct execution of the work required.

L. Submittals shall be provided on all major electrical systems and/or equipment, including the following:

REMARKS LEGEND
Provide the following as indicated:

1. Factory Test Report
2. Field Testing Report
3. Record Drawings
4. Mock-Up
5. Material & Equip. List/Certificate
6. Operation & Maintenance Manuals
7. Construction Schedule
8. Points List
9. Sequence of Operation
10. Certificate of Inspection
11. Installer Certificate & Master Label
12. Fire Marshal Approval
13. Tools/Spare Parts
14. _____

Section Number	Section Title	Shop Dwgs.	Product Data	Letter of Intent	Samples	Warranty	Remarks
26 0500	Common Work Results for Electrical					X	6, 7, 10
	Materials List			X			5
	Electrical Systems Description						
26 0519	Low Voltage Electrical Power Conductors and Cables (0-600V)						
	Cable			X			1
	Splicing Connectors			X			
	Termination Lugs			X			
26 0526	Grounding and Bonding for Electrical Systems						
	Grounding Cable			X			
	Grounding Connections/fittings			X			

Section Number	Section Title	Shop Dwgs.	Product Data	Letter of Intent	Samples	Warranty	Remarks
26 0533	Raceways and Boxes for Electrical Systems						
	EMT Conduit and Fittings			X			
	RGS Conduit and Fittings			X			
	PVC Conduit and Fittings			X			

1.11 PROJECT RECORD DOCUMENTS

A. Project Record Documents: Revise layout shop drawings as required during construction to indicate the as-built condition.

1. At the completion of the Project, resubmit to the Owner's Representative the revised set of “redlined” bluelines, (or electronic files with all changes from the bid documents bubbled) and one set of prints indicating “as-built” conditions for Owner's record. 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 “Final Issue” conditions in title.
2. Furnish and deliver to the Owner’s Representative a manual of all shop drawings and product data upon substantial completion. The manual shall consist of a standard hard cardboard, vinyl covered, 3-ring binder, letterhead size, 8-1/2” x 11”. Shop drawings shall be folded and punched. All items and pages shall be numbered with typewritten index inserted at front of manual.
3. Submit final project record documents as described in Division 1.

1.12 OPERATION AND MAINTENANCE MANUALS AND EQUIPMENT

A. Operation and Maintenance Manuals: The manuals shall contain operating instructions, service instructions, parts lists, etc., which are shipped with electrical equipment. On completion of the work, transmit these items to the Architect/Engineer, for the Owner's use. If this information is not shipped with the equipment, obtain from the manufacturer.

B. 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 attached to the "Final Application" for payment.

C. Furnish three (3) sets of bound operation and maintenance manuals to the Architect/Engineer. Each set shall include:

1. One (1) copy of all shop drawings and product data
2. One (1) copy of operation and maintenance instructions and manuals
3. One (1) copy of all electrical testing results
4. One (1) copy of as-built drawings

1.13 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.

1.14 WARRANTY

A. Warranty: Provide a one year parts and labor warranty for all equipment and installation. Comply with requirements of the General Conditions.

1.15 DESCRIPTION OF ELECTRICAL SYSTEMS

A. Small Power System: 208/120 volts, 3 phase, 4 wire, 60 hertz, solidly grounded neutral.

1.16 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.

B. Provide control wiring greater than 100 volts for temperature, pressure, level and control devices, solenoid valves, control relays, and MCC control wiring, and all power wiring, required for equipment specified hereinafter.

C. The principal items of electrical work to be furnished and installed shall include but not necessarily be limited to the following items:

1. A building wide BAS system including low voltage wires in new conduits from BAS control panel to various electrical and mechanical equipment.
2. Branch circuit wires in new conduit from existing electrical panel to existing or new BAS control panel including direct buried underground conduit between buildings.

1.17 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Excavating, trenching, and backfilling for electrical – Division 31, except as specified in Division 26.

B. Furnishing and installing low voltage control wiring – Divisions 21, 22 and 23, except where otherwise indicated.

C. Furnishing and installing field prime and finish painting – Division 09, except as specified in Division 26.

PART 2 - PRODUCTS

2.1 SEALING OF OPENINGS

A. Seal openings around electrical materials (Conduit, raceways, etc.) where fire rated walls 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 Section 078413 “Through Penetration Firestop Systems”.

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.

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. Refer to Division 01 for requirements for cutting, patching and refinishing work necessary for the installation of Electrical Work.

B. Direct miscellaneous cutting and patching of the existing building construction for the installation of the Electrical Work.

C. 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.

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. Electrical work which may interfere with changes in piping, ducts or other mechanical equipment, as well as conduits and outlets that may be uncovered by the cutting of new openings in present building shall be removed at the direction of the Architect/Engineer.

3.2 EXCAVATION AND BACKFILL

A. Furnish excavating and backfilling to install work specified in the Electrical Division. Refer to electrical drawings and Division 31 for methods and materials.

3.3 EQUIPMENT FOUNDATIONS AND SUPPORTS

A. Furnish foundations and supports for electrical equipment and materials as required by codes, as listed hereinafter and shown or noted on the Drawings.

B. Provide necessary inserts, rod, structural steel frames, brackets, platforms, etc., for equipment suspended from ceilings or walls, such as conduits, transformers, panels, etc.

C. 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.

D. Provide and install concrete bases 4" above finished floor, with leveling channels, where noted, for floor-mounted equipment such as unit substations, transformers, switchboards, distribution panels, motor control centers, etc.

E. Enclosures for panelboards, motor starters, disconnect switches and motor control centers shall be mounted on 1/2” spacers when mounted in a room below grade on exterior walls or 1/4” spacers when mounted in a room at or above grade on an exterior wall.

3.4 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 which, in the opinion of the Owner’s Representative, causes interferences.

B. Should construction conditions prevent the installation of switches, conduit, outlet boxes, junction boxes, conductors, lighting fixtures and/or other related 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.

C. The Electrical 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 which installed the Work, but the cost shall be paid by the Electrical Trades.

3.5 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, motors, elevator controllers, 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.

3.6 TESTS ON CABLES, LOW-VOLTAGE (600V MAXIMUM)

A. General:

1. Provide visual and mechanical inspection of all cables.
2. Verify identification the new 120 volt circuits on the panel directories.
3. Test and verify thorough operational tests that the new 120 volt circuits perform all the functions for which they were designed.

B. Visual and Mechanical Inspection:

1. Inspect and compare cable data including size and quantity of cables with drawings and specifications. Report differences in test report and include on contractor’s “as-built” drawings.
2. Inspect exposed sections of cables for physical damage.
3. Inspect bolted electrical connections for high resistance using one of the following methods:

    a. Use of low-resistance ohmmeter.
    b. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data.
    c. Perform thermographic survey.

4. Inspect compression-applied connectors for correct cable match and indentation.
5. Inspect for correct phase identification and phase arrangements.
6. Inspect jacket and insulation condition.

C. Electrical Tests:

1. Perform resistance measurements through bolted connections with low-resistance ohmmeter.
2. Megger Test: Perform insulation-resistance test for each conductor with respect to ground conductors. Test duration shall be one minute. Applied potential shall be as follows:

   a. 500 volts DC for 300 volt rated cable.
   b. 1000 volts DC for 600 volt rated cable. Minimum permissible insulation-resistance.
   c. Tested value shall be 50 megohm for isolated cables and 5 megohms for non-isolated cables.

3. Perform continuity tests to insure correct cable connection.

D. Connections: Isolate power cables to be megger tested by opening switches or breakers at each end of cable prior to testing where such disconnecting means exists. Where cables are direct connected without a disconnecting means, do not disconnect cables; test as connected.

E. Acceptance: Cable must pass all inspections and tests.

3.7 TESTS ON CONTROL WIRING

A. General: Give each single conductor and multi-conductor control wire or cable a continuity test and an insulation strength test. Verify identification of conductors.

B. Connections: Disconnect and fan out conductors to be tested.

C. Insulation Strength Tests:

1. Subject each control wire to a 1000 volt, 60 hertz test.
2. Apply test between each conductor in a wire group and ground with all other conductors in the wire group grounded to the same ground. Use a test set having an accurate means of insuring 1000 volt test voltage and provide a series resistance to limit fault when a ground is found. Hold test voltage only long enough to read instruments. Test each conductor in the same manner.
3. In lieu of the above insulation strength test, megger each control wire as specified for 480 volt power conductors.

D. Acceptance: Wires must pass all tests.

E. Records:

1. Include the following information in test report on each wire group.

   a. Wire and group identification.
   b. Type of test, insulation strength or megger.
   c. When megger testing is selected, include information as specified for 480 volt power cables.

3.8 FIELD QUALITY CONTROL

A. Testing Conduits: Conduits which are installed underground shall be cleared of foreign material and obstructions after installation and before conductor or pullwires 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 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. Tests shall include branch circuits, etc.
3. Perform all tests required by State, City, County and/or other agencies having jurisdiction.
4. Provide all materials, equipment, etc., and labor required for tests.
5. Perform cable and equipment testing as specified.

C. Cleaning:

1. 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 electrical systems clean and ready for use.
2. Final clean-up shall include washing of fixture lenses, switchboards, substations, transformers, motor control centers, distribution 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.

D. Painting:

1. In general, no painting is required by Electrical Trades other than touch-up of factory-finished electrical equipment.
2. All factory finished electrical 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.

E. Laying Out Exterior Work:

1. All exterior manholes, handholes, utility poles, lighting poles, bollards and similar equipment shall be staked by this contractor and approved by the engineer prior to installation.

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.

B. Related Sections including the following:

1. Cable tests as specified in Section 260570.

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.
2. Lugs
3. Labels
4. Insulating tape

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 unless otherwise specified. 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. Wire for Direct Burial or In Underground Duct or Conduit: Single or multi-conductor, as indicated on the Drawings, NEC Type USE rated 75 degC, 600 volts.

D. Cable types MC, MI, NM, NMC or NMS shall not be used unless specifically noted on the drawings or in the specifications.

2.2 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 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"

2.3 TERMINAL BLOCKS

A. Terminal Blocks for Use in Control Wiring of Control Panels and Terminal Cabinets: Molded barrier type rated 30 amperes, 600 volts, with washer head binding screws and white marking strip.

1. Manufacturer: Provide one of the following:

    a. Cutler-Hammer, Inc., Bulletin 10987
    b. General Electric EB-5
    c. Marathon 2000 Series

2.4 INSULATING TAPE

A. General Use Tape:

1. Tape shall be vinyl all weather designed for continuous operation in -18°C to 105° applications and shall be 7 mils thick.

2. Manufacturer: Provide one of the following:

a. Okonite Type CLF Catalog Series 602-20
b. 3M Scotch Super 33

2.5 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 equipments, 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. 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.

E. 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.

F. 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.

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. 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.

C. Insulate all bare surfaces of conductors with a minimum of four layers (half lap in two directions) of electrical insulating tape.

3.4 FIELD QUALITY CONTROL

A. Perform testing on all conductors as indicated in the Electrical Testing and Power Systems (26 0570) Section.

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. For General Use Below Grade: Insulated.
b. In Conduit with Phase Conductors: Insulated.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Ground electrical system neutrals and non-current carrying parts of electrical equipment per the minimum requirements of the National Electrical Code, except where additional requirements are indicated or specified.

1.4 SUBMITTALS

A. General: Submit the following according to the 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. Grounding connections and fittings

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. Bare Grounding Conductors: stranded annealed copper.

B. Insulated Grounding Conductors: stranded annealed copper insulated with a heat and moisture resistant polyvinyl chloride compound and meeting UL Requirements for Type (THWN) (XHHW), 75 degC, rated 600 volts, color-coded green. Conductor No. 10 AWG and smaller may be solid in lieu of stranded.

1. Manufacturer: Provide products of one of the following:

a. Southwire
b. Cerrowire
c. Encore
d. General Cable
e. Prysmian
f. Republic Wire

2.2 GROUNDING CONNECTIONS

A. Grounding Fittings for Bonding a Ground Conductor to Its Own Conduit:

1. Manufacturer: Provide products of one of the following:

a. Appleton Type GIB
b. Burndy Type NE
c. Penn Union Type BD
d. O-Z Type GB
e. Thomas & Betts Type TIG or 3800 Series

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install conductors of size required by the NEC. except that where sizes are otherwise indicated, provide these sizes.

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.

END OF SECTION 26 0526

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. Raceway systems as required, and all equipment and material, including conduit, fittings, boxes, wireways, and cable trays, as indicated or specified.

1.3 SUBMITTALS

A. Product Data: Submit complete data on each item. Coordinate the items, as they relate to the work, prior to submittal. Shop drawings shall include:

1. Conduit and fittings
2. Boxes

B. Submit Owner's Operation and Maintenance Manuals for systems and equipment as follows:

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Work in Hazardous Areas in accordance with Article 500 of the National Electrical Code.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Galvanized Steel (RGS) Conduit, Elbows, and Couplings: Zinc-coated hot dip galvanized threaded steel per ANSI C80.1 "Specification for Rigid Steel Conduit, Zinc-Coated" and UL6. Each length of conduit shall be threaded on both ends.

1. Manufacturer: Provide products of one of the following:

a. Allied
b. Republic
c. Wheatland

B. Electrical Metallic Tubing (EMT): Zinc-coated steel per ANSI C80.3-1977 "Specification for Electrical Metallic Tubing, Zinc-Coated".

1. Manufacturer: Provide products of one of the following:

a. Allied
b. Republic
c. Wheatland

2.2 ELECTRICAL PLASTIC CONDUIT

A. Heavy Wall Conduit: Schedule 40, 90 C, UL-rated, construct of polyvinyl chloride (PUC) and conforming to NEMA TC-2, for direct burial, or normal aboveground use, UL-listed and in conformity with NEC Article 347.

B. Manufacturers: Provide products of one of the following:

1. Cantex
2. Prime Conduit, Inc.
3. National Pipe

2.3 CONDUIT FITTINGS

A. Fittings for Rigid Galvanized Steel Conduit: Cast or malleable iron bodies, cadmium or zinc-plated, with taper threads, screw attached cover plates, and gaskets when located in areas requiring gaskets as specified in Part 3.

1. Manufacturer: Provide products of one of the following:

a. Appleton Form 35
b. Crouse-Hinds Form 8
c. Steel City/Thomas & Betts
d. Topaz

B. Couplings and Connectors for EMT: Zinc-plated steel, compression or set screw type.

1. Manufacturer: Provide products of one of the following:

a. Appleton
b. ETP
c. Midwest
d. Steel City/Thomas & Betts

C. Conduit Unions on Continuous Run:

1. Manufacturer: Provide products of the following:

a. Erickson

D. Bushings for 1 Inch and Smaller Rigid Steel Conduits: Insulating plastic type of non-burnable thermosetting phenolic, conforming to Underwriters' Laboratories requirements. Do not furnish non-rigid plastic bushings.

2.4 OUTLET BOXES

A. Sheet Steel 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. Appleton
b. RACO
c. Steel City

B. Cast or Malleable Iron Boxes: Galvanized or cadmium plated, 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. Appleton
b. Crouse-Hinds
c. Pyle-National
d. Russelstoll
e. Steel City/Thomas & Betts

PART 3 - EXECUTION

3.1 CONDUIT SYSTEMS

A. Install RGS conduits for all exposed exterior locations and wet locations.

B. EMT compression type connectors and couplings shall be used for all EMT conduits routed in damp locations or when the use of EMT in lieu of RGS is approved by the Engineer for exposed exterior locations. The use of set screw connectors and couplings is permitted for all other EMT raceways where equipment ground wires exist.

C. 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. 3/4" conduit minimum shall be used from the panelboards to the junction boxes and between junction boxes.

D. Install all exposed and concealed conduit runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings.

E. Group conduit for common support, where indicated and elsewhere as directed by the Architect-Engineer.

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 Section 078413 "Through-Penetration Firestop Systems".

H. 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.

I. 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.

J. Use one hole malleable iron galvanized pipe straps for support of single conduits, or clevis type hangers. Support groups of conduit 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.

3.2 OUTLET, SWITCH, JUNCTION AND PULL BOXES

A. Outlet Boxes for Use with Rigid Steel Conduit in Non-Hazardous Areas: Sheet steel for flush or concealed work in dry locations; cast or malleable iron in exposed, damp or wet locations. Do not use sheet steel outlet boxes in utility or factory areas.

B. Outlet Boxes for Use with Electrical Metallic Tubing: Sheet steel for flush or concealed work; cast or malleable iron for exposed locations.

C. Pull and Junction Boxes for Use with Each Type of Conduit: As specified for outlet boxes for each conduit type under above paragraphs.

D. 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.

E. Above suspended ceilings, support boxes to the building steel or structural floor above and independent of the ceiling pads; flush mounted boxes for suspended ceilings fasten boxes to the ceiling support system by bar hanger or other approved support; flush boxes in drywall ceilings fasten boxes to ceiling support system by bar hanger or other approved support system.

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
2. Raceway identification
3. Power and control cable identification
4. Underground-line warning tape
5. Cable ties

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.

2.2 RACEWAY IDENTIFICATION

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits as specified voltages:

1. Black letters on a yellow field for 250V or less.
2. Legend for Systems below 600V: Indicate voltage.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 POWER AND CONTROL CABLE IDENTIFICATION

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.4 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Power Conduits and Cables Red-Colored Tapes with these legends: ELECTRIC LINE FOR SYSTEMS LESS THAN 600V.
3. Communications Conduits and Cables Orange-Colored Tapes with the appropriate legends: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag:

1. Multilayer laminate consisting of high-density polyethylene scrim coated with pigmented polyolefin, bright-colored, [**continuous-printed on one side with the inscription of the utility**] compounded for direct-burial service.
2. Thickness: 12 mils.
3. Weight: 36.1 lb/1000 sq. ft.
4. 3 Inch Tensile According to ASTM D 882: 400 lbf, and 11,500 psi.

2.5 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. 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.

G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. In Spaces Handling Environmental Air: Plenum rated.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

I. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

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.
b. Monitoring and control equipment

3.3 RACEWAYS AND CONDUCTOR IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits 100 amperes or more and 120 volts or more to ground:

1. Self-adhesive vinyl tape applied in bands. Install labels at 30 foot maximum intervals.

B. Conductor Identification, 600 V or Less:

1. Identify individual phase conductors, neutral conductor and ground conductor of branch power and lighting circuits as to phase and system voltage by means of color coding in conformance with Sections 200-6 and 210-5 of the NEC.

2. Use the following identification scheme unless there are existing schemes being utilized by the Owner:

Phase			Neutral		Equipment Grounding Conductor	System
A	B	C	Normal Power	Emergency Power		
X	Y	Z	N	N	GRD.	Any Voltage
Black	Red	Blue	White	White/Red tracer	Green	120/208 Volt
Brown	Orange	Yellow	Gray	Gray/Red tracer	Green/Yellow Tracer	277/480 Volt

3. Where color schemes deviate from above, submit color schemes for approval of the Architect-Engineer prior to implementation. Provide conductor color coding by means of colored insulating materials or by means of colored wire labels attached to individual conductors in all outlet, pull or junction boxes and at all terminations.
4. Install color coding scheme labels at each switchboard, panelboard, distribution panel, power panel and motor control center.
5. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

C. Tags shall be 1/8 inch thick lead die-stamped tags with punched ears. Fasten tags around the cable group or conduit with No. 12 AWG copper wire.

D. Identify cables entering or exiting conduits, passing through pull boxes, at each pullbox and at each termination location.

E. Designate source and load, or feeder or cable identification on tags. Submit identification for the approval of the Architect-Engineer.

F. Underground Lines:

1. Identify with underground-line warning tape for power, and control wiring.
2. Install underground-line warning tape for cables in raceway.

END OF SECTION 26 0553