Pittsburg State University

RUSS HALL 112 OFFICE CONSOLIDATION

A – 014310

Building number #38500-0001

PITTSBURG, KANSAS

AUGUST 2021

CLARK | HUESEMANN
927 ½ MASSACHUSETTS STREET
LAWRENCE, KANSAS 66044
PHONE: (785) 691-5547
EMAIL ADDRESS: jhuesemann@clarkhuesemann.com

ROSS & BARUZZINI
5350 W 94th TERRACE #102
PRAIRIE VILLAGE, KANSAS 66207
EMAIL ADDRESS: dphelan@rossbar.com

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1.1 DESIGN PROFESSIONALS OF RECORD

A. ARCHITECT'S PROFESSIONAL SEAL

B. ARCHITECT:

1. Jane Huesemann, AIA, Clark Huesemann LC.

2. State of Kansas license #4328

3. Responsible for Specification Divisions 01-12 Sections.

4. Responsible for Drawing Sheets: G001, G100, A100, D101, A101, A102, and A600.

PART 1 - DOCUMENT 000107 – SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. ENGINEER'S PROFESSIONAL SEAL

B. ENGINEER:

1. Daniel Patrick Phelan

2. State of Kansas license #25835

3. Responsible for Specification Division 23

4. Responsible for Drawing Sheets: M000, M101, M102

PART 1 - DOCUMENT 000107 – SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. ENGINEER'S PROFESSIONAL SEAL

B. ENGINEER:

1. Jeffrey G. Wheeler

2. State of Kansas license #16527

3. Responsible for Specification Divisions 26, 27 and 28

4. Responsible for Drawing Sheets: E100, ED101, E101, E102

DOCUMENT 000115 - LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Axe Library Phase 1 Renovation.

B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

1. GENERAL INFORMATION
G001 - COVER

2. ARCHITECTURAL
A100 – SYMBOLS, NOTES, & PARTITION TYPES
D101 – PARTIAL DEMOLITION PLAN
A101 – PARTIAL FLOOR PLAN AND DETAILS
A102 – PARTIAL REFLECTED CEILING PLAN
A600 – SCHEDULES AND SIGNAGE

3. MECHANICAL AND ELECTRICAL
M000 – MECHANICAL SYMBOLS AND ABBREVIATIONS
M101 – MECHANICAL DEMOLITION & NEW WORK PLANS
M102 – MECHANICAL DETAILS & SCHEDULES
E100 – SYMBOLS LEGEND
ED101 – ELECTRICAL DEMOLITION PLAN
E101 – PARTIAL FIRST FLOOR ELECTRICAL PLAN
E102 – ELECTRICAL SCHEDULES

END OF DOCUMENT 000115

SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under Owner’s separate contracts.
4. Owner-furnished, Contractor-installed products.
5. Contractor’s use of site and premises.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and Drawing conventions.
9. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

2. Section 017300 "Execution" for coordination of Owner-installed products.

1.2 PROJECT INFORMATION

A. Project Identification: Pittsburg State University, Russ Hall 112 Office Consolidation, Project Number: A-014310.

1. Project Location: 1701 S Broadway, Pittsburg, KS 66762.

B. Owner: State of Kansas, Pittsburg State University.

1. Owner's Representative: Lindell Haverstic, University Architect.

C. Architect: Clark Huesemann LC, 927 ½ Massachusetts Street, Lawrence, KS 66044; Jane Huesemann, AIA.

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

1. Mechanical, Electrical Engineering: Ross & Baruzzini, 5350 W 94th Terrace #102, Prairie Village, KS 66207; Dan Phelan, P.E.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

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

1. Interior Renovation of an office suite on the 1st floor including (5) new private offices with architectural finishes work and related mechanical and electrical. Other Work indicated in the Contract Documents.

B. Type of Contract:

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

1.4 WORK UNDER OWNER'S SEPARATE CONTRACTS

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

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

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.

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

1. Provide for delivery of Owner-furnished products to Project site.
2. Upon delivery, inspect, with Contractor present, delivered items.

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

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

C. 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.

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

1. Paint. Refer to Section 09 9123 for requirements specific to Owner and Contractor.

1.6 CONTRACTOR'S USE OF SITE AND PREMISES

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

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

1. Limits: Confine construction operations to areas of work shown on drawings.
2. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, the public, 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. Refer to Drawings for identified areas for site access and storage of materials.

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.

1.7 COORDINATION WITH OCCUPANTS

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

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
3. Maintain separations between Construction Areas and Occupied Areas indicated on Drawings, until removal of barrier is approved by the authorities having jurisdiction.

1.8 WORK RESTRICTIONS

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

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

B. On-Site Work Hours: Schedule work in the existing building accordingly to meet restrictions indicated on Drawings.

1. Weekend Hours: Coordinate with Owner.
2. Early Morning Hours: Coordinate with Owner.
3. Hours for Utility Shutdowns: Coordinate with Owner.
4. Hours for Core Drilling or other Noisy Activities: Coordinate with Owner.

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 providing temporary utility services according to requirements indicated:

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

1. Notify Architect 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. Tobacco-Free Campus: Refer to PSU’s Tobacco Free Campus guidelines.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

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

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

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

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
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 2300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

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

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

1.3 PROCEDURES

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

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

B. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: New Plastic Laminate Countertop for existing casework

1. Base Bid: Casework countertops are existing to remain.

2. Alternate: Provide new Plastic Laminate to cover existing countertops, backsplashes, and side splashes as indicated in the Drawings. Laminate finish to be selected by architect from manufacturer's full range of finish colors.

   Provide new base cabinet doors and hardware at sink in Kitchenette as indicated in the Drawings, to match existing door finishes.

END OF SECTION 01 2300

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

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

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

1.3 ACTION SUBMITTALS

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

1. 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.

2. 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 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.

1.4 QUALITY ASSURANCE

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

1.5 PROCEDURES

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

1.6 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. Requested substitution provides sustainable design characteristics that specified product provided for compliance with LEED requirements, if applicable.
c. Substitution request is fully documented and properly submitted.
d. Requested substitution will not adversely affect Contractor's construction schedule.

e. Requested substitution has received necessary approvals of authorities having jurisdiction.
f. Requested substitution is compatible with other portions of the Work.
g. Requested substitution has been coordinated with other portions of the Work.
h. Requested substitution provides specified warranty.
i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

B. Related Requirements:

1. Section 01 4000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
2. Section 01 7700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
3. Section 01 7823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 01 7839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 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."

1.3 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. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.

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

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

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled date of fabrication.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.4 SUBMITTAL FORMATS

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

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

B. Options: Identify options requiring selection by Architect.

C. 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.

D. Paper Submittals (formatting requirements for PDFs):

1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.

2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using transmittal form.

E. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

F. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections. Email is required unless Contractor Provides optional web-based project software.

1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. 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.

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

1. Initial Review: Allow 7 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 7 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 10 days for initial review of each submittal.

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

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

E. 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.

F. 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.

1.6 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 unless submittal based on Architect's digital data drawing files is otherwise permitted.

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

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

2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).

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 Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. 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.

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

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

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

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

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.

1.7 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 signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

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

1.8 CONTRACTOR'S REVIEW

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

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

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

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

1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
2. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.

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

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

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

E. Architect will discard 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

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Testing and inspection services are required to verify compliance with requirements specified or 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, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 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.

1.3 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.

1.4 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.

1.5 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.

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

1. Project quality-control manager may also serve as Project superintendent.

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

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner-performed tests and inspections indicated in the Contract Documents.

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

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

1.6 REPORTS AND DOCUMENTS

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

1. Date of issue.
2. Project title and number.
3. Name, address, 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.

1.7 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. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.

1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. 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.

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

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, 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.

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

1.8 QUALITY CONTROL

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

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

C. 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. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

E. 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.

F. 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.

G. 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.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

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

1. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
5. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

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

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

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

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

3.2 REPAIR AND PROTECTION

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

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

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

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

END OF SECTION 01 4000

SECTION 01 7700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

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

B. Related Requirements:

1. Section 01 7823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
2. Section 01 7839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
3. Section 01 7900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 DEFINITIONS

A. List of Incomplete Items: 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.

1.3 ACTION SUBMITTALS

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

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

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

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 SUBSTANTIAL COMPLETION PROCEDURES

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

B. Submittals Prior to Substantial Completion: Complete the following 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 Owner. 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 sustainable design submittals not previously submitted.
7. 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.

1.7 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 Section 01 2900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. 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 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.

1.8 LIST OF INCOMPLETE ITEMS

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, 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. Name of Architect.
d. Name of Contractor.
e. Page number.

4. Submit list of incomplete items in one of the following formats:

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

1.9 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, by uploading to web-based project software site, or by email to Architect.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

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

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

a. Clean Project site 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.

q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
r. Clean strainers.
s. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 5000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in [Section 01 5000 "Temporary Facilities and Controls."] [Section 01 7419 "Construction Waste Management and Disposal."]

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 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

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

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for general closeout procedures.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.

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

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

1.3 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. Revisions to routing of piping and conduits.
d. Revisions to electrical circuitry.
e. Actual equipment locations.
f. Duct size and routing.
g. Locations of concealed internal utilities.
h. Changes made by Change Order or Construction Change Directive.
i. Changes made following Architect's written orders.
j. Field records for variable and concealed conditions.
k. 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. 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. Format: Annotated PDF electronic file with comment function enabled.
3. 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.
4. Identification: As follows:

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

1.4 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: Submit Record Product Data as a portion of the Operation and Maintenance Manual.

1. Include Record Product Data directory organized by Specification Section number and title.

1.5 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 02 4119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.

1.2 DEFINITIONS

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

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

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

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

1.3 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 INFORMATIONAL SUBMITTALS

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

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

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

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

D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

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

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.7 FIELD CONDITIONS

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

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical. Owner will remove the following items in preparation for construction:

   a. Furniture: loose chairs, tables, filing cabinets.
   b. Office electronic items: such as computers, phones.

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

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

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

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

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

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

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

C. Survey of Existing Conditions: Record existing conditions by use of *preconstruction photographs or video*.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PROTECTION

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

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

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

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

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

3.3 SELECTIVE DEMOLITION, GENERAL

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

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

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

C. Removed and Salvaged Items:

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

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.

3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

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

3.4 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

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

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

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

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

3.5 DISPOSAL OF DEMOLISHED MATERIALS

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

1. Coordinate with Owner for items to be recycled through Owner’s recycling operations.
2. Do not allow demolished materials to accumulate on-site.
3. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

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

B. Burning: Do not burn demolished materials.

3.6 CLEANING

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

B. END OF SECTION 02 4119

SECTION 064600- WOOD TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Interior trim.
2. Door trim
3. Interior paneling.
4. Built-in shelving and cabinetry.

1.3 ACTION SUBMITTALS

A. Samples: For each exposed product and for each color and texture used.

B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

C. Samples for Verification:

1. For each species and cut of lumber and panel products with nonfactory-applied finish, with half of exposed surface finished; 50 sq. in. (300 sq. cm) for lumber and 8 by 10 inches (200 by 250 mm) for panels.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Wood Products: Comply with the following:
1. Hardboard: AHA A135.4
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
3. Particleboard: ANSI A208.1, Grade M-2.
4. Hardwood Plywood: DOC PS 1 plies are fabricated with veneer cores.
5. Softwood Plywood: DOC PS 1, Medium Density Overlay.

B. Lumber: DOC PS 20 and the following grading rules:
1. NeLMA: Northeaster Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."
2. NHLA: National Hardwood Lumber Association, "Rules for the Measurement and Inspection of Hardwood & Cypress."
3. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
4. SPIB: The Southern Pine Inspection Bureau: "Standard Grading Rules for Southern Pine Lumber."
5. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
6. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."

C. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, mark grade stamp on end or back of each piece.

2.2 INTERIOR TRIM

A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: to match existing trim to remain.
2. Maximum Moisture Content: 10 percent.
3. Matching: Selected for matching grain and color.
4. Match existing for wood detailing and configurations.

2.3 PANELING

A. Hardwood Paneling for Transparent Finish (Stain or Clear Finish):
   1. Species and Grade to match existing paneling to remain.
   2. Thickness: match existing.
   3. Panel Size: match existing.
   4. Matching: Selected for matching grain and color.
   5. Face Pattern: match existing
   6. Finish: Match existing.

2.4 SHELVING AND CABINETRY

A. Hardwood Paneling for Transparent Finish (Stain or Clear Finish):
   1. Species and Grade to match existing paneling to remain.
   2. Thickness: match existing.
   3. Panel Size: match existing.
   4. Matching: Selected for matching grain and color.
   5. Face Pattern: match existing
   6. Finish: Match existing.

B. Shelf Supports: Match existing style and finish

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible, and fabricated to match existing.

2.6 FABRICATION

A. Match existing fabrication style and configuration.
B. Match existing stains and/or protective coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
3. Coordinate interior finish carpentry with materials and systems in or adjacent to it.

3.4 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements.

1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

B. Adjust joinery for uniform appearance.

3.5 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces.

B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.6 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Acoustical joint sealants.

B. Related Sections:

1. Section 092900 "Gypsum Board" for sealing perimeter joints.

1.3 ACTION SUBMITTALS

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

B. Samples for Initial Selection: Manufacturer's color charts consisting of ACTUAL strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

B. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

D. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 PROJECT CONDITIONS

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

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

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

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Colors of Exposed Joint Sealants: Generally match color of adjacent materials and further as selected by Architect from manufacturer's full range.

2.2 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

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

a. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
b. Tremco Incorporated; Vulkem 921 or Dymonic FC.

2.3 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

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

a. Pecora Corporation; AC-20 FTR or AIS-919.
b. USG Corporation; SHEETROCK Acoustical Sealant.

2.4 JOINT SEALANT BACKING

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

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

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

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include, but are not limited to concrete, masonry, and unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include, but are not limited to metal, glass, porcelain enamel and glazed tile surfaces.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to

comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

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

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

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

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

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

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

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

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at

perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

    a. Perform five (5) tests for the first 500 feetof joint length for each kind of sealant and joint substrate.
    b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealant dimensions and configurations comply with specified requirements.
    c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

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

3.6 PROTECTION

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

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Sealant Location:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Joints between stainless steel backsplashes and walls and other associated food service equipment.
c. Other joints as necessary.

2. Joint Sealant: Single-Component, Acid-Curing Silicone Joint Sealant.
3. Joint-Sealant Color: Clear.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Perimeter joints of exterior openings where indicated.
b. Tile control and expansion joints, unless otherwise indicated.
c. Vertical joints on exposed surfaces of walls and partitions.
d. Perimeter joints between interior wall surfaces and frames of interior doors, interior windows and interior dissimilar materials.
e. Other joints as necessary.

2. Joint Sealant: Urethane Joint Sealant.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors. Generally, color shall closely match adjacent wall color, or be paintable.

C. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Location:

a. Acoustical joints where indicated by partition types.
b. Other joints as necessary.

2. Joint Sealant: Acoustical joint sealant.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range. Generally, color shall closely match adjacent wall color.

END OF SECTION 079200

SECTION 081433 – STILE AND RAIL DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Stile & Rail doors of grade specified
2. Machining of stile & rail doors
3. Finishing of stile & rail doors

B. Related Requirements:

1. Section 062046 – Wood Trim
2. Section 088000 - Glazing
3. Section 087100 – Door Hardware
4. Section 099300 – Staining and Transparent Finishing

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Indicate door core materials, thickness, construction, veneer species. See WDMA “A Specifier’s Guide to Door Face Veneers” for cut and matching requirements, factory machining and factory finishing criteria.

B. Shop Drawings:

1. Submit shop drawings under provisions of AWS Section 1 of all doors included in this section to the architect for approval.
2. Include plan and elevation views, detailed section, trim members, construction type, stile and rail construction (stiles, rails, panel raise, moldings), stile and rail joints, hardware, finishing requirements

C. Construction samples: Submit one or more of manufacturer’s standard samples demonstrating door construction.

D. Finish samples: illustrating the range of color and grain of the specified door face materials.

E. Product Data: Indicate door core materials, thickness, construction, veneer species. See WDMA “A Specifier’s Guide to Door Face Veneers” for cut and matching requirements, factory machining and factory finishing criteria.

F. Indicate compliance with positive pressure.

G. Manufacturer’s full lifetime warranty

1.4 REFERENCES AND REGULATORY REQUIREMENTS

A. ASTM - Methods of Fire Tests and Door Assemblies.

B. NFPA 252 - Standard Methods for Fire Assemblies.

C. UBC 7-2, 1997

D. UL 10 (b) - Fire Tests for Door Assemblies - Neutral Pressure

E. NFPA 80 - Fire Doors and Windows.

F. Quality Standards:
1. WDMA Industry Standard I.S. 6A (Window and Door Manufacturers Association).
2. AWS Quality Standards Edition 1
3. ANSI A115. W Series, Wood Door Hardware Standards. (American National Standard Institute)
4. LEED_NC Version 3

G. Labeling Agencies
1. Underwriters Laboratories, Inc. (UL) (Neutral pressure and positive pressure rated doors)
2. Intertek Testing Services-Warnock Hersey (ITS-WH) (Ratings for both neutral and positive pressure rated doors)

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products under provisions of AWS, and manufacturer’s care and handling instructions.

B. Accept doors on site in manufacturer’s standard packaging. Inspect for damage. Do not store in damp or wet areas. HVAC systems should be operating and balanced prior to arrival of doors. Acceptable humidity shall be no less than 25% nor greater than 55%.

C. Protect doors from exposure to natural and artificial light after delivery.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eggers

2. Other manufacturers that meet product requirements

2.2 MATERIALS & MANUFACTURING METHODS

A. Workmanship: Comply with AWS workmanship for veneer faces, vertical edges, crossbands, horizontal edges and dimensional tolerances. Heavy Duty Performance Level

B. Door Construction Grade: Except as may be otherwise shown on the drawings fabricate the work of this section to AWS “Custom Grade”.

C. Door Facing
   1. Wood Veneer: Choose from the selection of grade, species, cuts and color as detailed by AWS Section 9, to best match existing doors.
   2. MDO (Medium Density Overlay for opaque finish).

D. Veneer Matching in panels
   1. Book Match
   2. Slip Match

E. Assembly of Spliced Veneers in panels
   1. Running book match

2.3 FABRICATION

A. All panel doors shall be manufactured using the traditional construction of panels grooved into adjacent stiles and rails with the stiles tongued and grooved, and doweled together with glue under pressure.

B. All exposed surfaces, including stiles, mullions, cross rails, etc. shall be manufactured using premium grade hardwood veneer. Door construction to include minimum 1/16” hardwood lumber stiles for superior durability.

C. Sticking shall be as detailed on the architectural drawings. Wood shall be the same species as the face veneer, unless otherwise noted. Vertical edges and edges adjacent to lites or panels shall be the same species as the face veneer.

D. Core shall be Structural Composite Lumber (SCL). Dowels used for assembly shall be no less than ½” x 5”

E. Raised panels shall be manufactured using a three ply construction. Minimum thickness of panel shall be 1 1/8”.

F. Panel raise shall be constructed from solid lumber matching the face veneer and shall be rim banded with mitered rim. Dimensions for panel raise shall be as indicated on drawings.

G. Bar and muntin details shall be as indicated on drawings. Solid lumber shall be used. Lumber species to the same as face veneer.

H. Standard face dimensions as noted in the Drawings to match existing door dimensions.

2.4 PREFIT AND PREMACHINE

A. Manufacturer to premachine for cutouts, hinges, locks and all hardware requiring routing or mortising.

B. The contractor is to furnish the wood door manufacturer with an approved coordinated schedule showing all the data relative to the frame, hardware and door information.

C. Hinge screw pilot holes to be bored by door manufacturer. Contractor shall be responsible for boring other pilot holes, wood screw holes, mounting holes for face plates and other surface applied hardware listed on the hardware schedule, unless special arrangements are made with the door manufacturer prior to submittal of shop drawings to the architect. Pilot holes must be drilled for all screws that act as hardware attachments. Full threaded screws are preferable for fastening hardware to non-rated doors and are required on fire-rated doors. Self-tapping or combination wood/metal screws are not to be used on wood doors.

D. Kickplates and other protective hardware shall be furnished by the hardware supplier or general contractor and installed in the field by the contractor.

2.5 FINISHES

A. Stain to match existing woodwork according to Section 099300 – Staining and Transparent Finishing

B. All panel tongues are to be sealed prior to door assembly.

C. All doors shall be individually poly bagged or plastic wrapped.

2.6 INSTALLATION

A. Installer must examine doors and door frames to verify that frames have been installed as required for proper hanging and operation of door. Doors with apparent defects should not be hung. Notify the door sub-contractor in writing of conditions which are detrimental to the p roper installation and operation of wood doors. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Do not deliver or install doors until temperature and relative humidity have been stabilized and will be maintained in storage and installation areas for the remaining construction period. Action on any claim for warp or photographing defects may be deferred at the option of the manufacturer for a period not to exceed twelve months, to permit conditioning of the doors to temperature and humidity. Re-seal or refinish before installation if field machining or alterations are required at job site.

C. Install fire doors in accordance with NFPA 80.

D. Doors shall swing in their respective frames free of hinge binding or improper latching. Protective door wrapping is to remain in place until all work by other trades is complete and final inspection is complete. Re-hang or replace doors which do not swing or operate freely.

E. Owner is to be furnished with instructions on how to clean and maintain wood doors.

END OF SECTION 081433

SECTION 087111 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

2. Cylinders for door hardware specified in other Sections.

B. Related Requirements:

1. Section 081433 Stile and Rail Doors
2. Refer to PSU Carpentry Standards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

a. Identification number, location, hand, fire rating, size, and material of each door and frame.
b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.

d. Fastenings and other installation information.
e. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
f. Mounting locations for door hardware.
g. List of related door devices specified in other Sections for each door and frame.

C. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

B. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the DOJ's "2010 ADA Standards for Accessible Design".

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in door hardware schedule.

1. Door hardware is scheduled on Drawings.

2.4 HINGES

A. 4 1/2 x 4 1/2 ball bearing, five knuckle, full-mortise template butt hinges.

B. Use three hinges per door.

C. Stanley FBB 179 for standard duty applications
1. Hager, McKinney and Bommer are accepted as equals

2.5 MECHANICAL LOCKS AND LATCHES (Match to existing building)

A. Best Access System 45H series by Stanley Security Solutions.

B. Schlage Lock Corporation; Allegion. L-Series.

2.6 LOCK CYLINDERS (Match to existing building)

A. Best Access System by Stanley Security Solutions
1. 1E74 22 (C4)

B. Schlage Lock Corporation; Allegion
1. 80-308

2.7 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

B. Standard Duty
1. Install all closers to doors with through bolt mounting
a. Norton 7500 Series
b. LCN 4010 Series

2.8 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

2.9 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.10 FINISHES

A. Provide finishes to Architect for verification in matching existing hardware finishes.

B. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

E. Stops: Provide wall stops for doors unless other stops are indicated in door hardware schedule.

F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

G. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

HARDWARE SET: 01

FOR USE ON DOOR #(S):

112A1-1 112A2-1 112A3-1 112B1-1 112B2-1

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	613	IVE
1	EA	OFFICE/ENTRY LOCK	9K37AB 14D	613	BES
1	EA	SFIC CORE	AS REQ'D TO MATCH EXISTING	613	BES
1	EA	WALL STOP	WS406/407CCV	613	IVE
3	EA	SILENCER	SR64	GRY	IVE

NOTE: WHERE SALVAGED DOORS ARE BEING RE-USED, SALVAGED HARDWARE TO BE RE-USED ALSO. HARDWARE SPECIFIED ABOVE FOR NEW DOORS/FRAMES ONLY.

PROVIDE FINISH SAMPLES TO ARCHITECT FOR VERIFICATION IN MATCHING EXISTING HARDWARE.

PROVIDE FLOOR STOP IN LIEU OF WALL STOP WHERE REQUIRED.

END OF SECTION 087111

SECTION 08800 GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. 081433 STILE AND RAIL DOORS

1.2 SUMMARY

A. Section Includes:

1. Patterned glass door lites.

1.3 DEFINITION

A. Glass Thickness: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For decorative glass. Show fabrication and installation details. Include the following:

1. Size and location.
2. Glazing method.
3. Mounting method.
4. Attachments to other work.

C. Glass Samples: For the following products, 12 inches (300 mm) square:

1. Each type of decorative glass.
   a. Provide samples to architect to match existing patterned glass.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer

B. Product Certificates: For each type of decorative glass.

C. Sample Warranty: For special warranty.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of decorative glass to include in maintenance manuals.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under NGA's Certified Glass Installer Program.

B. Sealant Testing Agency Qualifications: An independent testing agency qualified in accordance with ASTM C1021 to conduct the testing indicated.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect decorative glass and glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Retain packaging and sequencing numbers for decorative glass units.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install decorative glass until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of openings and construction contiguous with decorative glass by field measurements before fabrication.

1.12 WARRANTY

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS OF DECORATIVE GLASS

A. Source Limitations for Glass: Obtain each type of decorative glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer, for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design decorative glass.

C. Structural Performance: Decorative glass installed adjacent to walking surfaces shall withstand the following design loads within limits and under conditions indicated:

1. Differential deflection of adjacent unsupported edges shall not exceed glass thickness when subjected to 50 lbf/ft. (730 N/m) applied horizontally to one panel at any point up to 42 inches (1067 mm) above the adjacent walking surface.
2. Base design on thickness at thinnest part of the glass.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with glass product manufacturers' written instructions.

2.4 GLASS PRODUCTS

A. Tempered Patterned Glass: ASTM C1048, Kind FT fully tempered, finish, pattern, and quality to match existing glass in existing doors.

2.5 GLAZING MATERIALS

A. Glazing Sealants, Tapes, and Miscellaneous Glazing Materials per manufacturer’s recommendations.

1. Color and pattern: As selected by Architect from manufacturer's full range to match existing glass.

2.6 HARDWARE FOR GLASS INSTALLATION

A. Hardware and fasteners: match existing
1. Dimensions: as indicated in Drawings and verified to match existing.

2.7 DECORATIVE GLASS FABRICATION

A. Fabricate decorative glass and provide other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with product manufacturer's written instructions and with referenced glazing standard.

1. Edge-Finished Glass Adhesive: Clear, nonyellowing, as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine decorative glass framing members, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Minimum required face or edge clearances.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate orientation of outer surfaces. Label or mark units as needed so that surface orientation is readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 INSTALLATION

A. Set decorative glass units in each series true in line with uniform orientation, pattern, draw, bow, and similar characteristics.

3.4 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, gaskets, sealants, tapes, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels[**and between glass-to-glass joints**] to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants smooth.

3.6 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.7 DECORATIVE GLASS SCHEDULE

A. Patterned Glass for new doors to match existing patterned glass in existing doors.

END OF SECTION 088000

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.

B. Related Requirements:

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

1.4 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft. (239 Pa).

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
2. Protective Coating: ASTM A653/A653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.

1. Steel Studs and Tracks:

a. Minimum Base-Steel Thickness: As indicated on Drawings.
b. Depth: As indicated on Drawings.

2. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional ASTM C645 steel studs and tracks.

a. Minimum Base-Steel Thickness: As indicated on Drawings.
b. Depth: As indicated on Drawings.

C. Hat-Shaped, Rigid Furring Channels: ASTM C645.

1. Minimum Base-Steel Thickness: As indicated on Drawings.
2. Depth: As indicated on Drawings.

D. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

E. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-steel thickness of 0.0179 inch (0.455 mm), and depth required to fit insulation thickness indicated.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Z-Shaped Furring Members:

1. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
2. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09 2216

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Acoustical Batt Insulation.

B. Related Requirements:

1. Section 09 2216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Interior trim.
4. Joint treatment materials.
5. Laminating adhesive.
6. Sound-attenuation blankets.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Thickness: 1/4 inch (12.7 mm).
2. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. L-Bead: L-shaped; exposed long flange receives joint compound.
d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
e. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.6 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Type X: As indicated on Drawings and where required for fire-resistance-rated assembly.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 2900

SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and

ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 450 or less.

2.3 ACOUSTICAL PANELS (ACT)

A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

B. Type: Armstrong Ultima, 1911

C. Size: 2’ x 2’

D. Color: White.

E. Edge/Joint Detail: Square Tegular

F. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

G. Acoustical Panels: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

2.4 METAL SUSPENSION SYSTEMS

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

B. Armstrong standard 15/16” system.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
3. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
4. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

SECTION 09 9123 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Unless noted or specified otherwise paint and finish all exposed surfaces using the combination of materials listed on Painting Schedule in part 4 of this section, as specified herein, and as needed for a complete and proper installation.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and other Sections of these Specifications.
2. Priming or priming and finishing of certain surfaces may be specified to be factory-performed or installer-performed under pertinent other Sections.
3. Section 099300 Staining and Transparent Finishing.

C. Work not included:

1. Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces, and duct shafts.
2. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require painting under this Section except as may be so specified.
3. Do not paint moving parts of operating units; mechanical or electrical parts such as valve operators; linkages; sensing devices; and motor shafts, unless otherwise indicated.
4. Do not paint over required labels or equipment identification, performance rating, name, or nomenclature plates.
5. Do not paint concrete which has been sandblasted.

D. Definitions:

1. “Paint,” as used herein, means coating systems, materials including primers, emulsions, epoxy, enamels, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.2 SUBMITTALS

A. Comply with pertinent provision for the Specification.

B. Product data: The Contractor shall Submit: For each paint system indicated, including:

1. Material List: An inclusive list of required coating material. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer’s catalog number and general classification. Apply coats on Samples in steps to show each coat required for system.
2. Preparation instructions and recommendations.

3. Manufacturer's information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material (MSDS & PDS).

C. Samples:

1. Following the selection of colors and glosses by the Architect, submit Samples for the Architect's review.

a. If so directed by the Architect, submit Samples during progress of the work in the form of actual application of the approved materials on actual surfaces to be painted

2. Revise and resubmit each Sample as requested until the required gloss, color, and texture are achieved. Such Samples, when approved, will become standards of color and finish for accepting or rejection the work of this Section.
3. Do not commence finish painting until approved Samples are on file at the job site.

1.3 QUALITY ASSURANCE

A. Use adequate number of skilled workman who are thoroughly trained and experienced in the necessary craft and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Paint coordination:

1. Provide finish coats which are compatible with the prime coats actually used.
2. Review other Sections of these Specifications as required, verifying the primer coats to be used and assuring compatibility of the total coating system for the various substrates.
3. Furnish information on the characteristics of the specific finish materials to assure that compatible primer coats are used.
4. Provide barrier coats over non-compatible primers or remove the primer and re-prime as required.
5. Notify the Architect in writing of anticipated problems in using the specified coating system over prime-coatings supplied under other Sections.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label:

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

D. Do not apply paint in snow, rain, fog, or mist, or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.6 EXTRA MATERIALS

A. At beginning of the job deliver to owner one container of each type and color of paint used for draw downs. Properly labeled with color (formula for custom mixed colors). Minimum one gallon container is required with five gallon maximum.

B. Deliver to paint shop 104 Hartman hall.

C. Include Room finish Schedule with paint.

D. Include MSDS for all materials delivered.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: PPG Architectural Finishes Inc.; One PPG Place, Pittsburgh, PA 15272. ASD Tel: (888) 774-7732. Fax: (888) 434-3127. Email: ppgspec@ppg.com Web: www.pittsburghpaints.com

B. Substitutions: Equal products of other manufactures approved in advance by the Architect and owner.

C. OWNER WILL PROVIDE PAINT AND PAINT MATERIALS. PAINT MATERIALS LISTED ARE FOR REFERENCE TO THE PREP WORK AND NUMBER OF COATS REQUIRED. Painter is responsible for materials needed for prep, application and cleanup.

2.2 PAINT MATERIALS - GENERAL

A. Materials Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish coat materials that have a VOC classification of 450 g/l or less.

2.3 COLOR SCHEDULES

A. Based on the Finish Schedule included in the drawings, provide the following paint colors. Architect to confirm color selections in field prior to final selections.

1. Paint colors to be selected to match existing building colors.

2.4 APPLICATION EQUIPMENT

A. For application of the approved paint, use only such equipment as is recommended for application of the particular paint by the manufacturer of the particular paint, and as approved by the Architect.

B. Prior to use of application equipment, verify that the proposed equipment is actually compatible with the materials to be applied, and that integrity of the finish will not be jeopardized by use of the proposed equipment.

2.5 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

C. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect in writing, about anticipated problems when using the materials specified over substrates primed by others.
2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer applicator before proceeding:

a. Confirmation of primer’s suitability for expected service conditions.
b. Confirmation of primer’s ability to be top coated with materials specified.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. After completing painting operation in each space or area, reinstall items removed using workers skilled in the trades involved.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer’s written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and re-prime.
2. Provide barrier coats over incompatible primers or remove primers and re-prime substrate.
3. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.

    a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
    b. Determine alkalinity and moisture content of surfaces by performing appropriate test. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

4. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view and dust off.

    a. Scrape and clean small, dry seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before applying primer.
    b. Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.
    c. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    d. Unless specifically approved by Architect, do not proceed with painting of wood surfaces until moisture content of the wood is 12% or less as measured by a moisture meter approved by the Architect.

5. Ferrous-Metal Substrates: Clean un-galvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.

    a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 10
    b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.

6. Nonferrous Metal Substrates: Clean nonferrous and galvanized surfaces according to manufacturer's written instruction for the type of service, metal substrate, and application required.

    a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying coating in a clean condition, free of foreign materials and residue.
2. Stir material before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using

3. Use only the type of thinners approved by manufacturer and only within recommended limits.
4. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Touch up on applied prime coats which have been damaged, and touch up bare areas prior to start of finish coats application.
2. Slightly vary the color of succeeding coats.

    a. Do not apply additional coats until the completed coat has been inspected and approved.
    b. Only the inspected and approved coats of paint will be considered in determining the number of coats applied.

3. Sand and dust between coats to remove defects visible to the unaided eye from a distance of five feet.
4. On removable panels and hinged panels, paint the back sides to match the exposed sides.

B. General: Apply high-performance coating according to manufacturer's written instructions.

1. Use applicators and techniques best suited for the material being applied.
2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Coating surface treatments and finishes are indicated in the coating system descriptions.
4. Provide finish coats compatible with primers used.
5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector cover, grilles, covers for finned-tub radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. The number of coats and film thickness required is the same regardless of application method.
2. Block filler on new concrete masonry units is to be applied by roller and not spray applied for proper coverage. Ensure all pours are filled before finish coat is applied.

D. Drying:

1. Allow sufficient drying time between coats, modifying the period as recommended by the material manufacturer to suit adverse weather conditions.
2. Consider oil-base and oleo-resinous solvent-type paint as dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and when the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

E. Brush applications:

1. Brush out and work the brush coats into the surface to an even film.
2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will note be acceptable.

F. Spray applications:

1. Except as specifically otherwise approved by the Architect, confine spray application to metal framework and similar surfaces where brush work would be inferior
2. Where spray application is used, apply each coat to provide the hiding equivalent of brush coats.
3. Do not double back with spray equipment to build up film thickness of two coats in one pass.

G. Completed work: Match the approved Samples as to texture, color, and coverage. Remove, refinish, or repaint, work not in compliance with the specified requirements.

H. Miscellaneous surfaces and procedures:

1. Exposed mechanical items;

a. Finish electric panels, access doors, conduits, pipes, ducts, grilles, registers, vents, and items of similar nature to match the adjacent wall and ceiling surfaces, or as directed by the Architect.

2. Interior: Use “smooth” finish where enamel is specified.
3. Exposed vents: Apply two coats of heat-resistant paint approved by the Architect.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the present of Contractor.
2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove non-complying paint from Project site, pay for testing, and repaint surfaces previously coated with the non-complying paint. If necessary, contractor may be required to remove non-complying paint from previously painted surfaces if, on repainting with specified paint, the two coating are incompatible.

3.5 CLEAN-UP

A. At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

B. Upon completion of painting, clean glass and paint spattered surfaces. Remove spattered paint by washing, scraping or other proper methods, and using care not to scratch or damage adjacent finished surfaces.

C. Correct damaged by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage from painting.

B. Provide “Wet Paint” signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

PART 4 - COATING SYSTEMS

4.1 INTERIOR PAINT SYSTEMS

A. Concrete and Masonry (Other Than Concrete Unit Masonry): Provide the following paint systems over interior concrete and brick masonry substrates:

1. Two finish coats over a primer.

a. Preparation: Allow concrete and masonry to cure for thirty (30) days under normal drying conditions. Remove all dirt, dust, grime, loose mortar and all other forms of contamination.
b. Primer: 4-603 Pittsburgh Paints: Interior/Exterior Alkali Resistant primer. Applied at a dry film thickness of not less than 1.2 mils (0.030 mm)
c. Finish: 6-8510 Pittsburgh Paints: Speed Hide Interior high luster semi gloss acrylic enamel: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
d. Finish: 6-411 Pittsburg Paint: SpeedHide interior Enamel Latex Eggshell. Applied at a dry film thickness of not less than 1.0 mil (0.025 mm)

B. Existing Concrete and Masonry (prefinished) (Other Than Concrete Unit Masonry): Provide the following paint systems over interior concrete and brick masonry substrates:

1. Two finish coats over a primer.

a. Preparation: Lightly sand existing paint to a dull finish. Remove all dirt, dust, grime, loose mortar and all other forms of contamination.
b. Primer: 17-921 Pittsburg Paints: Seal Grip Interior/Exterior Acrylic primer. Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
c. Finish: 6-8510 Pittsburgh Paints: Speed Hide Interior high luster semi gloss acrylic enamel: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
d. Finish: 6-411 Pittsburg Paint: SpeedHide interior Enamel Latex Eggshell. Applied at a dry film thickness of not less than 1.0 mil (0.025 mm)

C. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry:

1. Two finish coats over block filler and a prime coat.

a. Preparation: Allow mortar to cure for thirty (30) days under normal drying conditions. Remove all dirt, dust, grime, loose mortar and all other forms of contamination.
b. Block Filler: 6-15 Pittsburgh Paints; Speed Hide interior/exterior Masonry latex Block Filler. Applied at a dry film thickness of not less than 6.0 to 12.5 mils (0.152 to 0.318 mm). To be applied by roller only not sprayed and back rolled. Insure all pours are filled before applying primer coat.
c. Primer: 4-603 Pittsburgh Paints: Interior/Exterior Alkali Resistant primer. Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
d. Finish: 6-8510 Pittsburgh Paints; Speed Hide Interior high luster semi gloss acrylic enamel: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).

OR

e. Finish: 6-411 Pittsburg Paint: SpeedHide interior Enamel Latex Eggshell. Applied at a dry film thickness of not less than 1.0 mil (0.025 mm)

D. Existing Concrete Unit Masonry: (prefinished) Provide the following finish systems over interior concrete masonry:

1. Two finish coats over a primer.

a. Preparation: Lightly sand existing paint to a dull finish. Remove all dirt, dust, grime, loose mortar and all other forms of contamination.
b. Primer: 17-921 Pittsburgh Paints: Seal Grip Interior/Exterior Acrylic primer. Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
c. Finish: 6-8510 Pittsburgh Paints; Speed Hide Interior high luster semi gloss acrylic enamel: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).

E. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Two finish coats over a primer.

a. Preparation: Remove all dirt, grime and all other forms of contamination.
b. Primer: 6-2 Pittsburg Paints: SpeedHide interior Quick-Drying latex sealer: Applied at a dry film thickness of not less than 1.0 mil (1.025 mm)

OR

c. Primer: 6-1 Pittsburgh Paints: Speed Hide Interior Quick-Drying latex sealer: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
d. Finish: 6-8510 Pittsburgh Paints; Speed Hide Interior high luster semi gloss acrylic enamel: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).

OR

e. Finish: 6-1110 Pittsburgh Paints; interior semi gloss alkyd enamel finish: Applied at a dry film thickness of not less than 1.4 mil (0.036 mm).

OR

f. Finish: 6-411 Pittsburg Paint: SpeedHide interior Enamel Latex Eggshell. Applied at a dry film thickness of not less than 1.0 mil (0.025 mm)

F. Existing Gypsum Board: Provide the following finish system over interior gypsum board surfaces:

1. Two finish coats over a primer.

a. Preparation: Lightly sand existing paint to a dull finish. Remove all dirt, grime and all other forms of contamination.
b. Primer: 17-921 Pittsburgh Paints: Seal Grip Interior/Exterior Acrylic primer. Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).

c. Finish: 6-8510 Pittsburgh Paints; Speed Hide Interior high luster semi gloss acrylic enamel: Applied at a dry film thickness of note less than 1.0 mil (0.025 mm).

OR

d. Finish: 6-411 Pittsburgh Paints; SpeedHide interior Enamel Latex Eggshell. Applied at a dry film thickness of not less than 1.0 mil (0.025 mm)

OR

e. Finish: 6-1110 Pittsburgh Paints; interior semi gloss alkyd enamel finish: Applied at a dry film thickness of not less than 1.4 mil (0.036 mm).

G. Plaster: Provide the following finish system over new interior plaster surfaces:

1. Two finish coats over a primer.

a. Preparation: Make necessary repairs with appropriate material and remove all dirt, grime, loose mortar and all forms of contamination.
b. Primer: 4-603 Pittsburgh Paints: Interior/Exterior Alkali Resistant primer. Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
c. Finish: 6-8510 Pittsburgh Paints; Speed Hide Interior high luster semi gloss acrylic enamel: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).

OR

d. Finish: 6-411 Pittsburgh Paints; SpeedHide interior Enamel Latex Eggshell. Applied at a dry film thickness of not less than 1.0 mil (0.025 mm)

OR

e. Finish: 6-1110 Pittsburgh Paints; interior semi gloss alkyd enamel finish: Applied at a dry film thickness of not less than 1.4 mil (0.036 mm).

H. Existing and New, Wood, Hardboard, and MDF: Provide the following paint finish systems over new interior wood surfaces with less than 12% moisture content as measured by a moisture meter approved by the Architect.

1. Two finish coats over a primer.

a. Preparation: Lightly sand with the grain of the wood, appropriately seal all knots and sap streaks, repair cracks and defects with the appropriate patching compounds.
b. Primer: 17-931 Pittsburg Paints: Seal Grip Stain Killing primer. Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
c. Finish: 6-1110 Pittsburgh Paints; interior semi gloss alkyd enamel finish: Applied at a dry film thickness of not less than 1.4 mil (0.036 mm).

I. New trim, cabinets, or wooden doors with clear finish: Provide the following finish systems over new interior wood trim with less than 12% moisture content as measured by a moisture meter approved by the Architect.

1. Two finish coats over one stain and one sealer.

a. Preparation: Lightly sand with the grain of the wood using progressing grits of sandpaper until a smooth surface free of defects is achieved. Stir thoroughly, but do not shake. Sand lightly with fine sandpaper between coats to insure a smooth finish. Do not use steel wool.
b. Apply one coat of Min Wax stain to color selected by Architect.
c. Sealer: Apply one coat Olympic; Premium Interior Oil Base Sanding Sealer #41060
d. Finish: Apply two coat Olympic; Premium Interior Fast Dry Varnish Gloss # 43888 or Satin 43887

J. Ferrous Metal: Provide the following finish system over ferrous metal:

1. Two finish coats over primer.

a. Preparation: Remove all loose mill scale, rust and corrosion deposits and any other forms of contamination.
b. Primer: 6-208 (red) or 6-212 (white) Pittsburgh Paints: Speed hide Interior/Exterior Rust Inhibitive Steel primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
c. Finish: Coronado Rust Scat 31 Line gloss or 651 Line Satin: Applied at a dry film thickness of not less than 1.4 mil (0.036 mm).

OR

d. Primer: Pittsburgh Paint (spot prime exposed bare metal); 97-145 Series Pittguard DTR Epoxy Mastic: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm)
e. Finish: Pittsburgh Paints; 95-812 Series Pitthane Ultra Gloss Urethane Enamel: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

K. Existing Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Two finish coats over primer.

a. Preparation: Lightly sand existing paint to a dull finish. Spot prime bare metal. Remove all dirt, dust, grime and all other forms of contamination.
b. Primer: 6-208 (red) or 6-212 (white) Pittsburgh Paints: SpeedHide Interior/Exterior Rust Inhibitive Steel primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
c. Finish: Coronado Rust Scat 31 Line gloss or 651 Line Satin: Applied at a dry film thickness of not less than 1.4 mil (0.036 mm).

OR

d. Primer: 97-680 Series, Multi Prime; Low VOC Quick Dry Universal Primer. Applied at a dry film thickness of 3.0 to 4.0 mills.
e. Finish: 97-812 Series: Pitthane Ultra Gloss Urethane Enamel: Applied at a dry film thickness of not less than 20 mils (0.051 mm).

L. Zinc-Coated Metal: Provide the following finish systems over interior Zinc-coated metal surfaces:

1. Two finish coats over primer.

a. Preparation: Remove grease and oils with a quality pre-paint cleaning solution. If any oxidation has formed, thoroughly sand and remove all forms of contamination.
b. Primer: 6-204 Pittsburgh paints: Speed hide Interior/Exterior Zinc Chromate Metal primer: Applied at a dry film thickness of not less than 1.5 mils (0.050 mm).
c. Finish: Coronado Rust Scat 31 Line gloss or 651 Line Satin: Applied at a dry film thickness of not less than 1.4 mil (0.036 mm).

M. Existing Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces: (Prefinished)

1. Two finish coats over primer.

a. Preparation: Lightly sand existing paint to a dull finish. Spot prime bare metal. Remove all dirt, dust, grime and all other forms of contamination.

b. Primer: 17-931 Pittsburg Paints: Seal Grip Stain Killing primer. Applied at a dry film thickness of not less than 1.2 mils (0.030 mm). Finish: Coronado Rust Scat 31 Line gloss or 651 Line Satin: Applied at a dry film thickness of not less than 1.4 mil (0.036 mm).
c. Finish: Coronado Rust Scat 31 Line gloss or 651 Line Satin: Applied at a dry film thickness of not less than 1.4 mil (0.036 mm).

4.2 SHOP DRAWINGS

A. Information to be included: After project is completed; Delivered to and gone over with the supervisor of the paint shop 104 Hartman Hall.

1. Copy of room finish schedule of paint actually used.

a. Include Manufacturer's name for each paint used.
b. Manufacturer's Product number for each paint used.
c. Color name and number for each paint used.
d. Formulas for custom mixed colors.
e. Location where paint was used.
f. Include MSDS for each product used.
g. One new unopened gallon of each paint used and labeled.

END OF SECTION 09 9123

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

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 surface preparation and application of wood finishes on the following substrates:

1. Interior Substrates:

a. Flush wood veneer doors.
b. Dressed lumber (finish carpentry).
c. Exposed wood panel products.

B. Related Requirements:

1. Section 081433 "Stile and Rail Doors" for stains and transparent finishes on doors.
2. Section 064600 "Wood Trim" for stains and transparent finishes on wood trim and panel products.

1.3 DEFINITIONS

A. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.

1. Submit Samples on representative samples of actual wood substrates, 8 inches square.
2. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules.

2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the product proposed for use highlighted.
3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Stains and Transparent Finishes: 1 gal. (3.8 L) of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply finishes when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

Coronado Paint
Benjamin Moore & Co.
Diamond Vogel Paints.
Pratt & Lambert.
PPG Architectural Finishes, Inc.
Sherwin-Williams Company (The)

2.2 MATERIALS, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.

C. Stain Colors: **As selected by Architect from manufacturer's full range to match existing trim or door color and finish.**

2.3 WOOD FILLERS

A. Wood Filler Paste: MPI #91.

2.4 PRIMERS AND SEALERS

A. Alkyd, Sanding Sealer, Clear: MPI #102.

2.5 STAINS

A. Stain, Semi-Transparent, for Interior Wood: MPI #90.

2.6 POLYURETHANE VARNISHES

A. Varnish, Interior, Polyurethane, Oil-Modified, Satin (Gloss Level 4): MPI #57.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Interior Wood Substrates: percentage as recommended by finish manufacturer, when measured with an electronic moisture meter.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

B. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

C. Interior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
3. Sand surfaces that will be exposed to view and dust off.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces. INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

1. Polyurethane Varnish over Stain System: MPI INT 6.3E

a. Stain Coat: Stain, semi-transparent, for interior wood, MPI #90. Color to be selected by Architect to match existing wood in building.
b. First Intermediate Coat: Polyurethane varnish matching topcoat.
c. Second Intermediate Coat: Polyurethane varnish matching topcoat.
d. Topcoat: Varnish, interior, polyurethane, oil-modified, satin (Gloss Level 4), MPI #57.

END OF SECTION 099300

SECTION 123623 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

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 plastic-laminate countertops.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products and high-pressure decorative laminate.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples for Verification:

1. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of product.

1. Composite wood and agrifiber products.
2. High-pressure decorative laminate.
3. Chemical-resistant, high-pressure decorative laminate.
4. Adhesives.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.

B. Grade: Premium.

C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.

1. Provide products by the following manufacturer:
   a. Pionite
   b. Formica
   c. Wilsonart

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. Selected by Architect from manufacturer’s full line of color options.

E. Edge Treatment: not needed, refer to countertop section for Solid Surface Edge

F. Core Material: Medium-density fiberboard.

G. Core Thickness: n/a

1. Laminate is to be field applied to existing countertops.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Composite Wood Products: Products shall be made without urea formaldehyde.
2. Medium-Density Fiberboard: ANSI A208.2, Grade 130 .

2.3 MISCELLANEOUS MATERIALS

A. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.4 FABRICATION

A. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Before installing laminate, examine existing countertops for smooth and level substrates. Prepare existing countertop surfaces to receive new laminate as required.

3.2 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Secure backsplashes to walls with adhesive.
3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 123553

SECTION 230500 – BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections:

1. Materials and installation instructions common to mechanical systems.
2. Painting and finishing of mechanical work.
3. Selective Demolition.
4. Cutting and patching.

1.2 RELATED DOCUMENTS

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

B. Section 23 0100 “Basic Mechanical Requirements” applies to the work of this Section as if fully repeated herein.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following abbreviations are used throughout Division 23 Specification Sections:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. CR: Chlorosulfonated polyethylene synthetic rubber.
4. EPDM: Ethylene propylene diene terpolymer rubber.
5. NBR: Acrylonitrile-butadiene rubber.
6. NP: Nylon plastic.
7. PE: Polyethylene plastic.

8. PVC: Polyvinyl chloride plastic.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect ductwork interiors from the elements and foreign materials throughout construction. Deliver ducts with shop-applied impervious protective covering over all open ends. Maintain protective end coverings through shipping, storage, and handling to prevent entrance of dirt, debris, and moisture. Elevate stored ducts above grade. As ductwork is installed, remove protective end covering as each successive segment is connected, but with protective end covering maintained over open ends remaining exposed.

B. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 GENERAL MECHANICAL INSTALLATION REQUIREMENTS

A. Verify all dimensions by field measurements.

B. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

C. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

D. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

E. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

F. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.2 PAINTING AND FINISHING

A. For all painting and finishing work required for mechanical installations, refer to Division 09 Sections for application requirements.

B. Painting HVAC Work: Paint the following work where exposed to view in finished or unfinished spaces: Uninsulated steel piping, pipe hangers and supports, tanks that do not have factory-applied final finishes, all interior and exterior ferrous piping and appurtenances, including steel, galvanized steel, cast iron and ductile iron.

C. Steel Substrates: Primer, alkyd, anti-corrosive, for metal, MPI #79; plus topcoat of latex, interior, semi-gloss, MPI #54.

D. Galvanized-Metal Substrates: Primer, galvanized, water based, MPI #134; plus topcoat of latex, interior, semi-gloss, MPI #54.

E. Aluminum (Not Anodized or Otherwise Coated) Substrates: Primer, quick dry, for aluminum, MPI #95; plus topcoat of latex, interior, semi-gloss, MPI #54.

F. ASJ Insulation-Covering Substrates: Including pipe and duct coverings. Primer sealer, latex, interior, MPI #50; plus topcoat of latex, interior, semi-gloss, MPI #54.

G. Primers specified above may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

3.3 SELECTIVE DEMOLITION

A. Disconnect, demolish, and remove mechanical work as indicated on the Drawings, and as required for installation of new work shown. Coordinate with Division 26 for disconnection of power to electrically-powered equipment prior to demolition.

B. Remove accessible work in its entirety. Repair cut surfaces to match adjacent surfaces. Abandon in place embedded or buried work, unless noted otherwise.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.

C. Removal: Unless otherwise indicated, remove demolished pipe, duct and equipment from the Project site. Handle and dispose of in accordance with National, State, and Local regulations.

1. Relocation: Remove, store, clean, reinstall, reconnect, and make operational all work indicated for relocation.
2. Salvage: Remove and deliver to Owner all work indicated for salvage.

D. Refer to Division 01 Sections “Selective Demolition” and/or “Selective Structure Demolition” for additional requirements.

3.4 CUTTING AND PATCHING

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay. Perform cutting and patching in accordance with the following:

B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

C. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Install equipment and materials in existing structures.

D. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, pumps, and other mechanical items made obsolete by the new Work.

E. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

F. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

G. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

H. Repair cut surfaces to match adjacent installations.

I. Repair any building insulation or building fireproofing materials, whether new or existing, that are removed or scraped away in order to make a mechanical installation, so as to maintain an equivalent insulation or fire rating as existed without said mechanical installation.

J. Refer to Division 01 Sections “Execution” and/or “Cutting and Patching” for additional requirements.

END OF SECTION 230500

SECTION 230593 – TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
2. Adjusting total HVAC systems to provide indicated quantities.
3. Reporting results of the activities and procedures specified in this Section.

1.2 RELATED DOCUMENTS

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

B. Section 23 0100 “Basic Mechanical Requirements,” and Section 23 0500 “Basic Mechanical Materials and Methods” apply to the work of this Section as if fully repeated herein.

C. The following Sections contain requirements that relate to this Section:

1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. AMCA: Air Movement and Control Association.

C. NEBB: National Environmental Balancing Bureau.

D. SMACNA: Sheet Metal and Air Conditioning Contractors’ National Association.

1.4 SUBMITTALS

A. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

1.5 QUALITY ASSURANCE

A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB.

B. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports.

C. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC *National Standards for Total System Balance, 7th Edition* or from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

D. Instrumentation Type, Quantity, and Accuracy: As described in AABC *National Standards for Total System Balance, 7th Edition* or in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification" except where more stringent requirements are specified in this Section.

E. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire testing, adjusting, and balancing period. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and

fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

D. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible.

E. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

A. Before beginning testing, adjusting and balancing, verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so design conditions for system operations can be met.

3.3 TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC *National Standards for Total System Balance, 7th Edition* or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" except where more stringent requirements are specified in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Set HVAC system airflow and water flow rates within the following tolerances:

1. Air Outlets and Inlets: Plus or minus 10 percent.

3.4 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer. Include a list of the instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to the certified field report data, include pump curves and fan curves.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of testing, adjusting, and balancing Agent.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of testing, adjusting, and balancing Agent who certifies the report.
10. Summary of contents, including design versus final performance, notable characteristics of systems, and description of system operation sequence if it varies from the Contract Documents.
11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer, type size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from design values.
14. Test conditions for fans and pump performance forms.

E. Fan Reports: For all existing fan-powered terminal unit fans.

F. Duct Traverse Reports.

G. Air-Terminal-Device Reports: For each terminal unit, air inlet, and air outlet.

H. System-Coil Reports: For all reheat coils and water coils of terminal units.

I. Instrument Calibration Reports: For instrument calibration, include instrument type and make, serial number, application, dates of use, and dates of calibration.

END OF SECTION 230593

SECTION 230700 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes mechanical insulation for ductwork including the following:

1. Insulation Materials: Mineral fiber
2. Factory-applied jackets.
3. Tapes and securements.

1.2 RELATED DOCUMENTS

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

B. Section 23 0100 “Basic Mechanical Requirements,” and Section 23 0500 “Basic Mechanical Materials and Methods” apply to the work of this Section as if fully repeated herein.

C. The following Sections contain requirements that relate to this Section:

1. Division 23 Section “Metal Ducts” for internal duct liners.

1.3 DEFINITIONS

A. ASJ: All-service jacket.

B. FSK: Foil, scrim, kraft paper.

C. SSL: Self-sealing lap.

D. Thermal Resistivity: “R-values” represent the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1-inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between two exposed faces required to cause one BTU to flow through one square foot of material, in one hour, at a given mean temperature.

E. VOC: Volatile Organic Compound as defined by LEED v4 Credit EQc2.

F. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

G. Exposed Installations: Exposed to view. Examples include finished occupied spaces without ceilings, mechanical equipment rooms, courtyards and rooftop locations.

H. Concealed Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings or within duct shafts.

I. Conditioned Space: Spaces that are served by both a mechanical heating and mechanical cooling system are conditioned spaces. Heating-only spaces are not conditioned spaces. The space above a ceiling is considered conditioned space if the space directly below that ceiling is conditioned space. A vertical shaft is considered conditioned space if the spaces on all sides surrounding the shaft are conditioned spaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. MSDS (Material Safety Data Sheet) for each adhesive, mastic, sealant, and cement furnished.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have flame-spread index of 25 or less, and smoke-developed index of 50 or less, as determined by testing identical products per ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Exception: Flame-spread index of 25 or less, and smoke-developed index of 150 or less; is acceptable for insulation not installed in an air-handling duct, plenum, space above ceilings if used as a return air plenum, or air-handling equipment rooms if used as a return/exhaust/relief air plenum, or any other air-handling situation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section “Hangers and Supports.”

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Mineral Fiber Insulation:

a. CertainTeed Corp.
b. Johns Manville.
c. Knauf Insulation.
d. Manson Insulation Inc.
e. Owens Corning.

2. Tapes: Same as insulation manufacturer, or

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corp.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Polyguard Products, Inc.
e. Venture Tape.

3. Bands and Wire: Same as insulation manufacturer, or

a. ACS Industries, Inc.
b. C & F Wire.
c. Childers Products.
d. PABCO Metals Corporation.
e. RPR Products, Inc.

4. Insulation Pins and Hangers: Same as insulation manufacturer, or

a. AGM Industries, Inc.
b. GEMCO.
c. Midwest Fasteners, Inc.
d. Nelson Stud Welding.

2.2 INSULATION MATERIALS

A. Refer to Schedule in Part 4 for requirements about where insulating materials shall be applied.

B. Restrictions: Products shall not contain asbestos, lead, mercury, or mercury compounds. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

C. Adhesives shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

D. Product manufacturers and/or their product numbers notwithstanding, each adhesive, mastic, sealant, and cement shall have a VOC content not greater than the maximum allowable under LEED v4 Credit EQc2 regardless of whether or not this project is seeking LEED certification.

E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type III with factory-applied jacket.

1. Thermal Conductivity: 0.26 average maximum at 75°F mean temperature.
2. Density: 1.5 lb/cf (24-kg/cu. m) minimum.
3. Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.3 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136 and UL listed.

1. Width: 3-inches (75 mm).
2. Thickness: 6.5 mils (0.16 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.

1. Width: 2-inches (50 mm).
2. Thickness: 3.7 mils (0.093 mm).
3. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.4 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A167 or ASTM A240, Type 304; 0.015-inch (0.38 mm) thick, ½-inch (13 mm) wide with wing or closed seal.
2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020-inch (0.51 mm) thick, ½-inch (13 mm) wide with wing or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1½-inch (38-mm) galvanized carbon-steel washer.

C. Staples: Outward-clinching insulation staples, nominal ¾-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application. Verify that systems and equipment to be insulated have been tested and are free of defects. Verify that surfaces to be insulated are clean and dry. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs. Install multiple layers of insulation with longitudinal and end seams staggered.

E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer. Install insulation with least number of joints practical.

H. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

I. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

J. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4-inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1½-inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2-inches (50 mm) o.c.
4. For below ambient services, apply vapor-barrier mastic over staples.
5. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4-inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations:

1. Install pipe insulation continuously through pipe penetrations of fire-rated walls and partitions.
2. Install duct insulation continuously through duct penetrations of fire-rated walls and partitions, for cases where no fire or smoke damper is required.
3. Terminate duct insulation at fire or smoke damper sleeves for cases where fire or smoke dampers are used, but overlap duct insulation at least 2-inches (50 mm) onto sleeve.
4. Firestopping and fire-resistive joint sealers are specified in Division 07 Section “Penetration Firestopping.”

3.5 DUCT INSULATION INSTALLATION

A. See Part 4 Insulation Schedules for specific requirements.

B. The following ductwork items need not be insulated, unless noted otherwise:

1. Fibrous-glass ducts.
2. Metal ducts with internal duct liner.
3. Factory-insulated flexible ducts.

C. Secure all insulation on ducts and plenums with insulation pins. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

1. On duct sides with dimensions 18-inches (450 mm) and smaller, pins may be omitted.
2. On duct sides with dimensions 18-inches (450 mm) and larger, place pins along longitudinal centerline of duct. Space 3-inches (75 mm) maximum from insulation end joints, and 16-inches (400 mm) o.c.
3. On duct sides with dimensions larger than 36-inches (900 mm), place pins 16-inches (400 mm) o.c. each way, and 3-inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
4. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
5. Do not over-compress insulation during installation.
6. If using blanket insulation, impale insulation over pins and attach speed washers.
7. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

D. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2-inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with ½-inch (13-mm) outward-clinching staples, 1-inch (25 mm) o.c. Complete the vapor barrier by applying FSK tape specified in Part 2, or vapor-barrier mastic and sealant, at all joints, seams, and protrusions.

1. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
2. Install vapor stops for ductwork and plenums operating below 50ºF (10 C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3-inches (75 mm).

E. If using blanket insulation, overlap unfaced blankets a minimum of 2-inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18-inches (450 mm) o.c.

F. Unless factory-insulated, install duct insulation continuously and unbroken over duct-mounted accessories such as fans, coils, terminal units, humidifier housings, damper housings, airflow measuring station housings, etc.

G. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. If using board insulation, groove and score insulation to fit as closely as possible to outside and inside radius of elbows.

H. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

I. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-(150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6-inches (150 mm) o.c.

PART 4 - SCHEDULES

4.1 INSULATION SCHEDULES

A. Furnish and install duct, equipment, and piping insulation as specified above and in accordance with the schedules below. All insulation thicknesses and pipe sizes in the following tables are given in nominal inches. Where more than one type of allowable material or more than one type of field jacket is listed, the choice is contractor’s option.

B. Cold Surfaces: For piping, ductwork, and equipment surfaces operating below surrounding ambient temperature, all surfaces including but not limited to pipe, duct, flanges, fittings, valves of every kind, pumps, dampers, strainers, unions, and other appurtenances shall be insulated and shall include uninterrupted vapor barrier to avoid potential condensation.

DUCT INSULATION Service	Duct Shape	Duct Location	Minimum R-Value	Allowable Materials	Insulation Thickness	Field Jacket	Keyed Notes
Supply Air Service (including outdoor air that has been heated or cooled)	Round, Oval	ICC,ICN	R-3.5	FGBK	1.50	---	(4)
	Rectangular	ICC,ICN	R-3.5	FGBK	1.50	---	(4)

KEYED NOTES:

(1) *Insulate only if the exhaust is routed to an energy-recovery device.*
(2) *Insulate only between final isolation damper and penetration of building exterior.*
(3) *The specified field jacket is required only if less than 84-inches AFF.*
(4) *Omit insulation if duct is expressly called out to be internally lined.*

LEGEND:

ICC	Indoor, Concealed, in Conditioned space
ICN	Indoor, Concealed, in Non-conditioned space
IEC	Indoor, Exposed, in Conditioned space
IEN	Indoor, Exposed, in Non-conditioned space
FGBK	Fiberglass Insulation, 1.5-lb density, Blanket
FGBD	Fiberglass Insulation, 1.5-lb density, Board
FE	Flexible Elastomeric
CS	Calcium Silicate
FRW	Fire-Rated Wrap
AL	Aluminum
SS	Stainless Steel

END OF SECTION 230700

SECTION 233113 – METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2500 Pa). Metal ducts include the following:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

1.2 RELATED DOCUMENTS

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

B. Section 23 0100 “Basic Mechanical Requirements,” and Section 23 0500 “Basic Mechanical Materials and Methods” apply to the work of this Section as if fully repeated herein.

C. The following Sections contain requirements that relate to this Section:

1. Division 07 Sections “Penetration Firestopping” for fire-resistant sealants for use around duct penetrations and fire-damper installations in fire-rated floors, partitions, and walls.
2. Division 23 Section “Mechanical Insulation.”
3. Division 23 Section “Duct Accessories” for dampers, turning vanes, and flexible ducts.
4. Division 23 Section “Diffusers, Registers and Grilles.”
5. Division 23 Section “Testing, Adjusting and Balancing” for air balancing and final adjusting of manual volume dampers.

1.3 DEFINITIONS

A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C168.

1.4 PERFORMANCE REQUIREMENTS

A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by the design professional. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

B. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA *HVAC Duct*

Construction Standards – Metal and Flexible and performance requirements and design criteria indicated in Part 3 of this Section.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2016.

D. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.5 QUALITY ASSURANCE

A. AMCA Compliance: All spiral ducts shall bear the AMCA Certified Ratings Program seal for Air Leakage.

B. ASHRAE Compliance: Applicable requirements in ASHRAE Standard 62.1-2016, Section 5 - "Systems and Equipment" and Section 7 – "Construction and System Start-Up."

C. ASHRAE Compliance: Applicable requirements in ASHRAE Standard 90.1-2016, Section 6.4.4 – "HVAC System Construction and Insulation."

1.6 REFERENCES

A. ANSI/SMACNA Standard 006-2006 *HVAC Duct Construction Standards – Metal and Flexible*, as published by the Sheet Metal and Air Conditioning Contractors' National Association. 3rd ed. Chantilly, VA: SMACNA, 2005. All references to this document throughout this Section refer to this specific edition.

B. ANSI/SMACNA Standard 016-2012 *HVAC Air Duct Leakage Test Manual*, as published by the Sheet Metal and Air Conditioning Contractors' National Association. 2nd ed. Chantilly, VA: SMACNA, 2012. All references to this document throughout this Section refer to this specific edition.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Fibrous-Glass Duct Liner:

a. CertainTeed Corporation “ToughGard.”
b. Knauf Fiber Glass GmbH “Duct Liner E-M.”
c. Johns Manville Corporation “Permacote Linacoustic.”
d. Owens-Corning Fiberglas Corporation “Aeroflex Plus.”

2. Field-Applied Duct Sealant Materials:

a. Ductmate, Inc.
b. H.B. Fuller Construction Products Inc. (Childers and/or Foster brands)
c. Hardcast, Inc.
d. McGill Air Seal Corporation.

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA *HVAC Duct Construction Standards – Metal and Flexible* for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Sheet Gage: SMACNA standards notwithstanding, no material thinner than 26-gage is permitted for spiral-seam round duct, and no material thinner than 24-gage is permitted for all other ducts.

C. Galvanized Sheet Steel: Comply with ASTM A653 / A653M.

1. Galvanized Coating Designation: G60 (Z180) or G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill-phosphatized.

D. Reinforcement Shapes and Plates: ASTM A36 / A36M, steel plates, shapes, and bars; black and galvanized. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Comply with Articles 2.5 through 2.9, including all accompanying Tables and Figures, of the SMANCA HVAC Duct Construction Standards.

2.3 DUCT LINER

A. Fibrous-Glass Liner: ASTM C1071 flexible bonded mat of glass fiber; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers. Comply with NFPA 90A and with NAIMA AH124.

B. Thickness: 1-inch (25 mm).

C. Density: 1½-pound.

D. Thermal Conductivity (k-Value): Not more than 0.26 at 75ºF (0.037 at 24°C) mean temperature per ASTM C518.

E. Moisture Resistance: Not more than 3% by weight at 120°F, 95% relative humidity. Insulation shall not support or promote mold or fungus growth per UL 181, ASTM C665, and ASTM G21 tests.

F. Performance: Rated for 4000 fpm, 150°F air temperature. Sound absorption coefficients per ASTM C423 Type “A” mounting shall be as follows:

1. 125 Hz Octave Band: 0.10
2. 250 Hz Octave Band: 0.25
3. 500 Hz Octave Band: 0.50
4. 1000 Hz Octave Band: 0.70
5. 2000 Hz Octave Band: 0.82
6. 4000 Hz Octave Band: 0.83
7. NRC: 0.60

G. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84.

H. Liner Adhesive: Water based duct liner adhesive equal to Foster 85-60 and/or Childers CP-127. Comply with NFPA 90A and with ASTM C916.

I. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

1. Tensile Strength: Indefinitely sustain a 50-lb- (23-kg-) tensile, dead-load test perpendicular to duct wall.
2. Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8-inch (3 mm) into airstream.
3. Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

2.4 SEALANT MATERIALS

A. Two-Part Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal; Hardcast® Two-Part Sealing System, Uni-Cast® by McGill AirSeal Corporation, or equal.

B. One-Part Sealing System: Flexible, adhesive sealant, fiber-reinforced, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts. Examples of acceptable products include Uni-Mastic 181 by McGill, Foster 32-19, and Childers CP-146.

C. Water-Based Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

D. Formed-on Duct Connectors: Flange shop roll-formed onto edge of ductwork, with corner closures, cleats and gaskets for seal; TDC or TDF constructed per SMACNA T-25a or T-25b.

1. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use O.
2. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.
3. Contractor’s Option: Proprietary manufactured slide-on duct connectors by Ductmate, Ward, or Nexus meeting the above requirements will be accepted wherever formed-on duct connectors are required by these specifications.

2.5 RECTANGULAR DUCT FABRICATION

A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA *HVAC Duct Construction Standards – Metal and Flexible*. Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, deflection limits, and joint types and intervals, except where more stringent requirements are specified herein.

B. All sheet metal shall be a minimum of 24-gage thickness in any case. Use 24-gage sheet metal where SMACNA allows thinner material.

C. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.

D. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

E. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359-inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of unbraced panel area, unless ducts are lined.

F. Pressure Classification: See Schedule in Part 3 of this Section.

G. Seal Classification: See Schedule in Part 3 of this Section.

H. Longitudinal Seams: Contractor's choice of Pittsburgh lock (SMACNA Figure 2-2 Type L-1) or Button Punch Snap Lock (SMACNA Figure 2-2 Type L-2) shall be used on all longitudinal seams. See "Seam and Joint Sealing" in Part 3 of this Section for further requirements.

I. Duct sizes shown on plans are free area sizes and do not include the thickness of internal duct liner, if any. For internally lined ductwork, increase the indicated duct dimensions to account for the liner thickness.

J. Contractor is free to alter the indicated sizes of rectangular duct to suit field conditions, provided that revised size is selected for friction loss no greater than that of indicated size. No prior approval by the Engineer is required for equal-friction duct size changes unless proposed size has an aspect ratio greater than 4 to 1.

K. All changes of direction shall be fabricated as elbows in accordance with SMACNA Figure 4-2 except that RE-4, RE-9 and RE-10 are prohibited. RE-6 is limited to a change-of-direction angle of 45 degrees or less.

L. Divided flow branches shall be Type 1 or Type 2 per SMACNA Figure 4-5. Type 3 divided flow branches are permitted only where expressly shown. Seek Engineer's approval of Type 3 where space and/or layout clearances prohibit Type 1 or Type 2.

M. Branch connections shall be per SMACNA Figure 4-6, except that straight taps are not permitted on any ducts 2-inch pressure class or above. Straight-tap "spin-in" fittings are permitted on ½-inch and 1-inch pressure class ductwork only.

N. Offsets and transitions shall be per SMACNA Figure 4-7, except that offset Type 2 (mitered) is limited to an angle of 45° or less.

O. Fittings at obstructions shall be per SMACNA Figure 4-8, except that Figure D is not permitted. Use Figure 4-8.B in lieu of Figure 4-8.D. Seek Engineer's approval of Figure 4-8.D where space and/or layout clearances prohibit use of Figure 4-8.B.

2.6 SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS

A. General: In general, supply air and outside air ducts will be externally insulated, not internally lined. Internal duct liner is not an acceptable substitute for external insulation. Use duct liner only where indicated.

B. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

C. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

D. Butt transverse joints without gaps and coat joint with adhesive.

E. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

F. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

G. Secure liner with mechanical fasteners 4-inches (100 mm) from corners and at intervals not exceeding 12-inches (300 mm) transversely; at 3-inches (75 mm) from transverse joints and at intervals not exceeding 18-inches (450 mm) longitudinally.

H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharges.
2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 /s) or where indicated.

I. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.7 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. Diameter as applied to flat-oval ducts in this Section is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Contractor's Option: The contractor is permitted to furnish spiral lock-seam round or flat-oval ductwork anywhere rectangular duct is indicated, provided the Contractor's coordination drawings demonstrate that adequate ceiling clearances and space required by other trades will permit round ductwork. If this option is chosen, round duct sizes shall be selected by the Contractor according to "equal friction" with respect to the rectangular sizes shown.

C. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA *HVAC Duct Construction Standards – Metal and Flexible* except that 26-gage is the thinnest material acceptable.

D. Longitudinal-seam round ducts ("stovepipe") of a minimum 24-gage thickness, will be permitted on ½-inch and 1-inch pressure classifications only; and only if the Seal Class specified in Part 3 of this Section can be achieved.

E. Flat-Oval, Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA *HVAC Duct Construction Standards – Metal and Flexible* except that 24-gage is the thinnest material available. With approval of Engineer, contractor may substitute flat oval duct where round duct is indicated, provided that revised size is selected for friction loss no greater than that of indicated size.

F. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA *HVAC Duct Construction Standards – Metal and Flexible*, with metal thicknesses specified for longitudinal-seam straight ducts.

G. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

H. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1½ times duct diameter. Adjustable-angle elbow fittings are not permitted. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA *HVAC Duct Construction Standards – Metal and Flexible* unless otherwise indicated.
2. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct.
3. 90-Degree, 2-Piece, Mitered Elbows: Use only if approved by the Engineer where space restrictions do not permit using radius elbows. Fabricate with turning vanes.
4. Round Elbows 8 Inches (200 mm) and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
5. Round Elbows 9 through 14 Inches (225 through 355 mm) in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows Larger Than 14 Inches (355 mm) in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.

2.8 HANGERS AND SUPPORTS

A. General: Support all ductwork in accordance with Chapter 5 of SMACNA *HVAC Duct Construction Standards – Metal and Flexible* except where more stringent requirements are specified herein.

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

C. Hanger Materials: Galvanized sheet steel or threaded steel rod. Primary duct hanger systems consisting of cable or wire are not acceptable; use steel angles, straps, and/or threaded rods.

1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
2. Strap and Rod Sizes: Comply with SMACNA *HVAC Duct Construction Standards – Metal and Flexible* for steel sheet width and thickness and for steel rod diameters.

D. All supporting material surfaces in direct contact with supported ductwork (or flexible duct, or duct insulation, as applicable) shall be designed to maintain a minimum of one-inch (25 mm) contact width along full length of contact.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports: Steel shapes complying with ASTM A36.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT PRESSURE CLASS SCHEDULE

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Constant-volume Supply Ducts: 2-inch wg (500 Pa).
2. Variable-volume Supply Ducts upstream of VAV boxes: 3-inch wg (750 Pa).
3. Transfer Ducts: 1/2-inch wg (125 Pa).

3.2 DUCT MATERIAL SCHEDULE

A. All ducts shall be galvanized steel.

3.3 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA *HVAC Duct Construction Standards – Metal and Flexible* unless otherwise indicated.

B. Install round and flat-oval ducts in lengths not less than 12 feet (3.7 m) unless interrupted by fittings.

C. Install ducts with fewest possible joints. Install fabricated fittings for changes in directions, size, and shape and for connections.

D. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12-inches (300 mm), with a minimum of 3 screws in each coupling.

E. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

F. Install ducts with a clearance of 1-inch (25 mm), plus allowance for insulation thickness.

G. Duct sizes shown on plans are free area sizes and do not include the thickness of internal duct liner, if any. For double wall duct and/or internally lined ductwork, increase the indicated duct dimensions to account for the liner thickness.

H. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

I. Install duct accessories as required by Division 23 Section “Duct Accessories.”

J. Coordinate layout with suspended ceiling, lighting layouts, and similar finished work.

K. Drawings are diagrammatic in nature. Not necessarily all fittings and offsets are shown. Provide all required fittings and offsets as required by field conditions and coordination with the work of other trades, whether specifically shown or not, for a complete and functional installation.

L. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

M. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

N. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1½ inches (38 mm).

O. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Firestopping materials and installation methods are specified in Division 07 Section “Penetration Firestopping.”

P. Protect duct interiors from the elements and foreign materials throughout construction. Follow SMACNA’s “Duct Cleanliness for New Construction.” Deliver ducts with shop-applied impervious protective covering over all open ends. Maintain protective end coverings through shipping, storage, and handling to prevent entrance of dirt, debris, and moisture. Elevate stored ducts above grade. As ductwork is installed, remove protective end covering as each successive segment is connected, but with protective end covering maintained over open ends remaining exposed.

3.4 SEAM AND JOINT SEALING SCHEDULE

A. General: Ducts noted as welded in the Duct Material Schedule above shall be made liquid-tight with all joints and seams full-penetration welded continuously along the entire length of the seam or joint. Otherwise, seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA *HVAC Duct Construction Standards – Metal and Flexible* except where more stringent requirements are specified herein.

B. Seal externally insulated ducts before insulation installation.

C. Seal Class Schedule: Seal Class A and Leakage Class 6 is required for all ducts except as noted below.

1. Spiral lock-seams need not be sealed.
2. Transfer air ducts and transfer air boots need not be sealed.

D. Rectangular Duct: Sealant materials and methods shall be at contractor's option, chosen from among the products specified in Part 2 of this Section; provided that the above seal class and leakage class schedule is met.

E. Round or Flat Oval Duct: Transverse joints shall be made with a SMACNA RT-1 interior slip coupling beaded at center, fastened to duct with screws; in addition, apply Two-Part Sealing System continuously around exterior side of joint.

1. Contractor's Option: Furnish prefabricated round duct connection system consisting of self-sealing gasketed fittings. Round duct joints made with this type of fitting do not require the additional sealant specified above, provided that specified seal class is achieved.

3.5 HANGING AND SUPPORTING

A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA *HVAC Duct Construction Standards – Metal and Flexible.*

B. Support horizontal ducts within 24-inches (600 mm) of each elbow and within 48-inches (1200 mm) of each branch intersection.

C. Support vertical ducts at one- or two-story intervals (i.e., 12 feet (3.66 m) to 24 feet (7.32 m).

D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

E. Install concrete inserts before placing concrete.

F. Install powder-actuated concrete fasteners after concrete is placed and completely cured. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4-inches (100 mm) thick.

G. Repair any building insulation or building fireproofing materials, whether new or existing, that are removed or scraped away in order to attach hangers and supports, so as to maintain an equivalent insulation or fire rating as existed without said hanger or support attachment.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."

B. Comply with SMACNA *HVAC Duct Construction Standards – Metal and Flexible* for branch, outlet and inlet, and terminal unit connections.

3.7 CLEANING NEW SYSTEMS

A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

B. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Create other openings to comply with duct standards.
2. Disconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling sections to gain access during the cleaning process.

C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Coils and related components.
4. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
5. Supply-air ducts, dampers, actuators, and turning vanes.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
5. Clean coils and coil drain pans according to ACR 2006. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

F. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

END OF SECTION 233113

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SECTION 233300 – DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Manual volume dampers.
2. Turning vanes.
3. Flexible ducts.

1.2 RELATED DOCUMENTS

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

B. Section 23 0100 “Basic Mechanical Requirements,” and Section 23 0500 “Basic Mechanical Materials and Methods” apply to the work of this Section as if fully repeated herein.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, “Installation of Air Conditioning and Ventilating Systems.”

B. Comply with AMCA 500-D testing for damper rating. All manufactured dampers of every type shall bear the AMCA Certified Ratings Program seal for Air Performance, Air Leakage, and Efficiency.

1.5 REFERENCED STANDARDS

A. Sheet Metal and Air Conditioning Contractors’ National Association. *HVAC Duct Construction Standards – Metal and Flexible.* 3rd ed. Chantilly, VA: SMACNA, 2005.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. HVAC Dampers (all types):

a. Air Balance Inc.; a division of Mestek, Inc.
b. Greenheck Inc.
c. Nailor Industries Inc.
d. Pottorff; a division of PCI Industries, Inc.
e. Ruskin Company.

2. Turning Vanes:

a. Ductmate Industries, Inc.
b. DuroDyne Inc.
c. Metalaire, Inc.
d. Semco Incorporated.
e. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

3. Flexible Ducts:

a. #087 by Atco Rubber Products, Inc.
b. Type 8M by Flexmaster USA, Inc.
c. “M-KE” by ThermaFlex.

2.2 MATERIALS

A. Comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible” for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A653/A653M and having G60 (Z180) or G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Minimum Thickness: All sheet steel used on this project shall be a minimum of 24-gage thickness, and all aluminum sheets shall be a minimum of 0.04-inch thickness, regardless of whether or not SMACNA standards permit thinner gage material.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

E. Tie Rods: Comply with Articles 2.5 through 2.9, including all accompanying Tables and Figures, of the SMANCA HVAC Duct Construction Standards.

2.3 MANUAL VOLUME DAMPERS

A. Manual volume dampers shall be standard leakage rating, with linkage outside airstream, suitable for horizontal or vertical applications. Volume dampers may be factory-manufactured or contractor-fabricated per SMACNA Fig. 7-4/7-5.

B. Material: Match material options throughout this subsection to the material of adjacent ductwork. For duct material, refer to Division 23 Section “Metal Ducts.”

C. Frames: Hat-shaped channels with mitered and welded corners, flanges for attaching to walls, and flangeless frames for installing in ducts.

1. Galvanized-steel, 16-gage or 0.064-inch (1.62-mm) minimum thickness, for use in galvanized steel ducts.
2. The above requirements may be reduced to 20-gage for round dampers installed in round ducts.

D. Blades: Multiple-blade; single-blade if duct dimension is 12-inch or less in the direction perpendicular to damper axis. Parallel or opposed-blade design (contractor's choice, unless a specific type is indicated). Stiffen damper blades for stability.

1. Galvanized-steel, 16-gage or 0.064-inch (1.62 mm) thick, for use in galvanized steel ducts.
2. The above requirements may be reduced to 20-gage for round dampers installed in round ducts.

E. Blade Axles: Galvanized steel, aluminum, or stainless steel, as required to match blade material. Dampers shall have axles full length of damper blades, and bearings at both ends of operating shaft.

F. Bearings: Oil-impregnated bronze, molded synthetic, and stainless-steel sleeve-type are acceptable.

G. Tie Bars and Brackets: Galvanized steel or aluminum.

H. Jackshaft:

1. Size: 1-inch (25-mm) diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

I. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a ¾-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 TURNING VANES

A. All turning vanes, where required, shall be single-thickness type, 2-inch (50-mm) radius, 1½-inch (38-mm) spacing, at least 24-gauge thickness, and curved through an arc matching the change of direction (i.e., a vane curved through 90-degrees for a 90-degree elbow). Construct of material matching that of the adjacent duct (i.e., galvanized steel turning vanes in a galvanized steel duct, stainless steel turning vanes in a stainless steel duct, etc.).

B. Where two or more changes of direction occur with less than four duct widths (measured in the plane of the change of direction) between each elbow, each turning vane shall also include a straight trailing edge extension of 1-inch (25 mm). At contractor's option, all turning vanes may include this straight trailing edge extension even if not required.

C. Include vane rails or runners for attachment of vane blades to duct.

D. Either contractor-fabricated or factory-manufactured turning vanes meeting these specifications will be acceptable.

2.5 FLEXIBLE DUCTS

A. General: Comply with UL 181, Class 1. Factory-fabricated, insulated, round duct, with an outer jacket enclosing glass-fiber insulation around a continuous inner liner.

1. Reinforcement: Galvanized steel wire helix encapsulated in inner liner.
2. Outer Jacket: Polyethylene vapor-barrier film.
3. Inner Liner: CPE film, acoustically transparent to mid-range sound energy.

B. Required Pressure Ratings:

1. Sizes 12-inch and smaller: At least 8-inch wg positive and 1-inch wg negative.
2. Sizes larger than 12-inch: At least 4-inch wg positive and ½-inch wg negative.
3. Burst Rating: 2.5 times working pressure rating above.

C. Velocity Rating: 4000 fpm.

D. Temperature Rating: -20°F to +250°F.

E. Thermal Rating: Minimum R-4.2 thermal resistance.

F. Flexible Duct Connector Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18-inches, to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible."

B. Install duct accessories of materials suited to duct materials.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts.

1. Locate dampers at least two duct diameters from fittings and as far away as possible from outlets.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Connect air devices to ducts with flexible duct clamped or strapped in place.

F. Connect air devices to ducts directly or with a minimum 36-inch (900-mm) and a maximum 72-inch (1800-mm) length of flexible duct clamped or strapped in place.

G. Install flexible ducts in accordance with the following:

1. Turn radius of flexible duct at duct centerline shall not exceed one times nominal duct diameter.
2. At least one support shall be installed for every run of flexible duct that is 60-inches (1500 mm) long or longer; more if needed to comply with next paragraph.
3. Support flexible duct so that it does not contact nor rest upon light fixtures, sprinkler and other piping, ceilings and ceiling hanger wires, electrical conduits and cable tray, and similar items.
4. All supporting material surfaces in direct contact with supported flexible duct shall maintain a minimum of one-inch in contact width along full length of contact.
5. Comply with Figures 3-10 and 3-11 in SMACNA's HVAC Duct Construction Standards – Metal and Flexible. 3rd ed. except where more stringent details are given on the Drawings.
6. Comply with Specifications 3.5, 3.6, and 3.7, paragraphs S3.19 through S3.40, of SMACNA's HVAC Duct Construction Standards – Metal and Flexible. 3rd ed., except where more stringent requirements are specified herein.

H. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Operate dampers to verify full range of movement.

B. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

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SECTION 233713 – DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.2 RELATED DOCUMENTS

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

B. Section 23 0100 “Basic Mechanical Requirements,” and Section 23 0500 “Basic Mechanical Materials and Methods” apply to the work of this Section as if fully repeated herein.

C. The following Sections contain requirements that relate to this Section:

1. Division 23 Section “Duct Accessories” for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
2. Division 23 Section “Testing, Adjusting, and Balancing” for balancing diffusers, registers and grilles.

1.3 DEFINITIONS

A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

C. Register: A combination grille and damper assembly over an air opening.

1.4 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

1.5 QUALITY ASSURANCE

A. Testing: Test and publish performance according to ANSI/ASHRAE Standard 70-2006 *Method of Testing the Performance of Air Outlets and Air Inlets*.

B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A-2015 *Standard for the Installation of Air-Conditioning and Ventilating Systems*. Where located less than 84 inches above finish floor, diffusers, registers and grilles shall be designed to prohibit passage of a ½-inch sphere.

C. Single-Source: Unless noted otherwise, a single manufacturer shall furnish all diffusers, registers, and grilles.

PART 2 - PRODUCTS

2.1 COMMON REQUIREMENTS, ALL UNITS

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

1. Air System Components Inc. (Titus, Krueger, and Tuttle & Bailey brands).
2. Carnes Co.
3. Hart & Cooley, Inc.
4. Metalaire, Inc.; Metal Industries Inc.
5. Nailor Industries, Inc.
6. Price Industries.

B. Diffusers, registers, and grilles are scheduled on Drawings. All model numbers, finish designations, border types, and accessory designations are based one manufacturer identified therein. Products by other manufacturers listed above may be furnished, but must be equal in all respects to the device identified, including but not limited to NC, pressure, and cfm ratings.

C. Diffusers, Registers, and Grilles Finish: Acrylic baked enamel paint, pencil hardness HB to H, color as scheduled. The finish shall pass a 250-hour ASTM 870 Water Immersion Test, a 100-hour ASTM D117 Corrosive Environments Salt Spray Test, and a 50 inch-pound ASTM D2794 Reverse Impact Cracking Test.

D. Integral Balancing Damper: Where dampers are scheduled as an integral part of diffusers and grilles (registers), provide multi-blade gang-operated opposed-blade type, radial-style if used with round ducts; 24 gage galvanized steel, except that aluminum dampers shall be used with aluminum diffusers and registers. Integral dampers shall be operable from the room side of the diffuser or register without special tools.

E. Diffusers, Registers, and Grilles Mounting: Provide border frame mounting type as scheduled. If not scheduled, provide border frame mounting type compatible with ceiling or wall type indicated on Architectural Drawings. Distinguish between flush flat-tee lay-in ceilings, drop-face lay-in ceilings, and the narrow-tee or screw-slot lay-in ceilings by providing a border type specifically designed for each as applicable; a generic standard lay-in border frame will not be acceptable for multiple lay-in ceiling types.

2.2 PRODUCT SPECIFICATIONS

A. Standard-Performance Grille: Adjustable double-deflection supply grilles, single fixed deflection return grilles, of sizes and performance as scheduled. Blades shall be 24-gage steel; supply grille blades shall be individually adjustable and held in place without rattling or slip by tension wire or metal friction pivots. Frame shall be roll-formed 24-gage steel or with 1-inch minimum

flange and full penetration welds at the corners. Exposed screw holes shall be countersunk for flush finish surface.

B. Other grilles, registers and diffusers not specified above may be specified on the Drawings or by virtue of make and model number on the Schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Install diffusers, registers, and grilles level and plumb.

C. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

D. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

E. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

F. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION 233713

SECTION 26 0500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section specifies the basic requirements for electrical installations and includes requirements common to all sections of Division 26. It expands and supplements the requirements specified in sections of Division 00. This section is also applicable to Division 27 “Communications” and Division 28 “Electronic Safety and Security”.

B. Drawings and general provisions of the Contract, including general and supplementary conditions and specification sections Divisions 00 through 01, apply to this Section.

C. Codes and Standards: All equipment, material and installations shall comply with applicable codes, standards, and installation practices. Comply with the requirements of the applicable local building codes, the applicable NEC, all local rules and regulations including those of the fire authorities. Comply with all applicable NFPA standards. All material and equipment shall be listed by the Underwriters Laboratories (UL) standard that is applicable for the specific purpose of the material and equipment. The National Electrical Code, National Electrical Manufacturer’s Association (NEMA) Standards, and applicable ANSI and IEEE standards shall apply to the pertinent materials, equipment, and installation practices. Testing shall be in accordance with the applicable International Electrical Testing Association (NETA) standards.

1. These specifications include references to the 2011 edition of the NFPA 70 "National Electrical Code." Where a different edition of the NEC has been adopted by the local Authority Having Jurisdiction, the references associated with that edition of the Code shall be applicable.

1.2 SUMMARY OF WORK

A. The word “furnish” means supply for use, the word “install” means install in its proper location and connect up complete and ready for operation, and the word “provide” means to furnish and install.

B. Provide all new materials as indicated on the drawings and specifications and all items required to make the electrical system complete and in working order.

C. System descriptions included in scope of work are as follows:

1. Electrical power systems, including luminaires, distribution equipment, motors, wiring devices, etc.
2. Electrical power distribution service from the Utility Company including metering.
3. Fire alarm system.
4. Power and communications for temperature control system.
5. Selective demolition work and modification of existing systems and equipment.
6. Low voltage systems as described in Divisions 27 and 28.
7. Low voltage systems rough-in, as indicated on drawings, for installation of low voltage equipment by others.

D. Work not included:

1. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) shall be by other Divisions.

1.3 WORK SEQUENCE

A. All work that produces excessive noise or interference with normal building operations shall be coordinated and scheduled with the Owner. Such work may require scheduling of work after occupied hours or weekends. The Owner reserves the right to determine when such work is conducted.

1.4 QUALITY ASSURANCE

A. Responsibility Prior to Submitting Pricing or Bid Data:

1. Thoroughly review the contract documents and specifications and visit the site prior to issuing bid. Resolve all reported deficiencies with the Engineer prior to awarding any subcontracts, ordering material, or starting any work.

B. Qualifications:

1. Only products of specified manufacturers, or approved equals as determined by the Engineer, are acceptable.
2. Employ only workmen who are skilled in their trades.

C. Compliance with Codes, Laws, and Ordinances:

1. Conform to all requirements of the state, city and local codes, laws and ordinances and other regulations having jurisdiction over this installation.
2. UFCs only apply to US Government Department of Defense Projects. Delete if not applicable.If there are any discrepancies between the codes and regulations and these specifications, the Engineer shall determine the method or equipment to be used.
3. Inform the Engineer in writing, requesting a clarification at the time of the bidding, if any parts of the drawings or specifications are found not to comply with the codes or regulations. Submit a separate price to make the system comply if there is insufficient time for this procedure.
4. Inform the Engineer in writing requesting a clarification if there is any discrepancy between a manufacturer’s recommendation and these specifications.
5. Follow the current issue of NFPA 70 “National Electrical Code” if there are no local codes having jurisdiction.

D. Utility Company Requirements:

1. Secure all applicable requirements from the private or public Utility Company.

E. Examination of Drawings:

1. The drawings for the indicated work are diagrammatic, intended to convey the scope of the electrical work and to indicate the general arrangements and locations of equipment, wiring devices, etc., and the approximate sizes of equipment. Field verification of dimensions on plans is required. The actual conditions, including heights, lengths and orientation shall be the basis of the work.
2. The architectural, structural, mechanical and electrical drawings and specifications shall be considered as mutually explanatory and complementary. Any electrical work called for

by one and not by the other shall be performed as though required by all. All sections and subsections of the Electrical work shall be governed by and subject to the general and supplementary conditions. Report any discrepancies in or between the drawings and specifications, or between the drawings and actual field conditions to the Engineer in sufficient time to issue an addendum for clarification.

3. Determine the exact locations for equipment and rough-ins, and the exact routing of raceways.
4. Do not scale drawings to determine equipment and system locations.
5. Not all required components are shown on the documents, including junction boxes, pull boxes, conduit fittings, etc. Provide all components required for proper installation of the work.
6. Any item either shown on the drawings or called for in the specifications shall be included in this contract.
7. Determine quantities and quality of material and equipment required from the documents. Provide the more expensive or higher quality amount where discrepancies arise among drawings, schedules or specifications.

F. Electronic Media and Files:

1. Electronic media files of the contract drawings in AutoCAD or PDF format and copies of the specifications in PDF format may be requested.
2. Complete and return a signed “Electronic File Transmittal” form provided by Ross & Baruzzini upon request for electronic media.
3. Obtain approval from the appropriate Design Professional for use of their part of the documents if the information requested includes information prepared by other than Ross & Baruzzini.
4. The electronic contract documents may be used for preparation of shop drawings and record drawings only. The information may not be used in whole or in part for any other project.
5. The drawings prepared by Ross & Baruzzini for bidding purposes may not be used directly for raceway layout drawings or coordination drawings.
6. The use of these documents does not allow relief from the responsibility for coordination of work with other trades and verification of space available for the installation.
7. The information is provided to expedite the project with no guarantee by Ross & Baruzzini as to the accuracy or correctness of the information provided. Ross & Baruzzini accepts no responsibility or liability for the use of the provided information.

1.5 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Coordinate equipment rough-in requirements with Divisions 02 through 28.

1.6 SUBMITTAL REVIEW RESPONSIBILITIES

A. General: Submittals are not requested for all products covered in the specifications. Submit only the data requested under the submittals portion of each specification section or where indicated in a Submittal Log, if included within Division 01. Un-requested submittals will not be processed or reviewed and will be returned to the submitter. Refer to “Submittal Register” for all required submissions of each specification section. All required submissions of that specification section are to be submitted for review in one all-inclusive submission. Any deviation from specified items is considered a substitution.

1. Non-requirement of submittals, when so noted, is not to be construed as an allowance for substitutions and does not provide relief from full compliance with the contract documents.
2. Any deviation from specified items is considered a substitution. A formal request for substitution must be submitted prior to bid date (no exceptions), in accordance with the procedures and time limitations set forth in Division 02, if the use of other than specified items is being proposed. Where not defined in Division 01, requests for substitutions shall be submitted no less than ten (10) working days prior to bid date. The submitter must pay the engineer for review of substitution requests. Charges for this substitution review will be calculated based on the Engineer's standard hourly rates, as defined in their contract with the Owner.

B. Definitions:

1. Product Data: Pre-printed manufacturer's data.
2. Shop Drawings: Drawings made specifically for the manufacture of a particular piece of equipment to be used on this project.
3. Operation and Maintenance Data: Information containing instructions on the proper operation, maintenance and repair of the equipment, complete with written text, diagrams, photos, exploded views and parts lists.
4. Record Documents: Information indicating the actual installed conditions of the project on Mylar, electronic media, photographs or typed paper. Photographs are not allowed as a substitute for correcting the construction documents; the photographs are for the Owner's future reference. Submit type, quantities and on media specified where indicated to be submitted.
5. Make sure what we want submitted is covered.

C. Where more than one model is shown on a manufacturer's sheet, clearly indicate exactly which item and which data is relevant to the work.

D. Where the manufacturer lists multiple part numbers or options on a single data sheet, the part number and options to be used shall be clearly set apart from other part numbers shown on that sheet.

E. Ensure that all submittals have been reviewed for total completeness and accuracy as to the requirements of the specifications and drawings before being submitted to the Engineer for review. The Contractor's approval stamp is required on all submittals before submittal to the Engineer. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Clearly mark all deviations from the contract documents on all submittals. The item shall be required to meet all drawing and specification requirements if deviations are not clearly marked.

1. One comprehensive submittal shall be provided for each individual specification section. All required submittal information called for in each individual specification section shall be included in the submittal. Partial or incomplete submissions will be rejected.
2. The Engineer shall not be responsible for informing the submitter on items that have not been included and are necessary for a complete review of the required submittal information for a specification section.
3. The Engineer shall have the option of returning any submittal, unmarked, if all required documentation called for in the specifications has not been provided in the submittal.
4. The Engineer shall review each submittal no more than two times and return to the submitter with the appropriate disposition.
5. If the Engineer is required to review a submittal a second time, it will be limited to review of the changed information, which must clearly be highlighted by the submitter. The submittal will be returned to the submitter with the appropriate disposition.

6. If the submittal is required to be reviewed a third time, it shall be done at the expense of the submitter. Charges for this additional submittal review will be calculated based on the Engineer's standard hourly rates, as defined in their contract with the Owner.

F. Operation and Maintenance Manuals: All items required for insertion into each Operation and Maintenance (O&M) Manual are called out in the submittals portion of each specification section or in a Submittal Log, if included within Division 01. Ensure that the O&M submittal has been reviewed and includes all the requirements of the specifications. Submit only the data requested under the submittals portion of each specification section. FAX or photo copies are not allowed as submittals for operating and maintenance manuals. The Engineer will review the submittal for the Operation and Maintenance Manual one time and return to the submitter with the appropriate disposition.

1. If the submittal is required to be reviewed a second time, it shall be done at the expense of the submitter. Charges for this additional submittal review will be calculated based on the Engineer's standard hourly rates, as defined in their contract with the Owner.
2. Submittals for the Operation and Maintenance Manual must be original documentation.
3. Photo copies of marked up Operations and Maintenance submittals are not acceptable.

G. Coordination Drawings: Prepare and submit Coordination Drawings as further described herein and as indicated in the Special Conditions. Provide the Engineer with one copy of all coordination drawings supplied to the Owner when required in this specification. Coordinate the work as outlined herein. Receipt by the Engineer of a copy of the coordination drawings is to verify conformance to the submittal requirements set forth in this specification section. It is not an admission by the Engineer as to the accuracy or completeness of the coordination proposed.

H. Refer to Division 01 and each individual Division 26 Section for additional submittal requirements.

1.7 PRODUCT OPTIONS AND MATERIAL SUBSTITUTIONS

A. Where two or more materials are listed in the "Part 2 – Products" subsection of any Division 26, 27 or 28 section, do not assume that the selection of materials is an option. Refer to "Part 3 – Execution" subsection of that same specification section for an explanation of which specific material(s) shall be used for which specific application(s). For example, Part 2 may list several types and grades of conductors, and Part 3 will describe which type and grade of conductors to use for a given application.

B. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work except as otherwise indicated.

C. Provide products which are compatible within systems and other connected items.

D. Substitutions: Products other than those specified must be submitted, approved and secured in writing from the Engineer via Addendum. If requested, a sample of the proposed substitution must be submitted to the Engineer for evaluation. This sample shall be supplied at no cost to the Engineer, and will be returned to the submitter, at the submitter's expense at the end of the evaluation period.

E. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis of design and establishes the quality required.

F. Any material, article or equipment of other unnamed manufactures which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Engineer via Addendum. Assume all costs incurred as a result of using the offered material, article or equipment, including the part of other Divisions whose work is affected.

G. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. Assume all costs incurred as a result of using the offered material or equipment on his part or on the part of other Divisions whose work is affected.

H. All material substitutions requested after the final Addendum must be listed as voluntary changes on the bid form.

1.8 PRODUCT, DELIVERY, STORAGE, HANDLING AND MAINTENANCE

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage and handling. Protect stored equipment and materials from damage.

B. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations. Review the site prior to bid for path locations and any required building modifications to allow movement of equipment.

C. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.

D. Keep all materials clean, dry and free from damaging environments.

1.9 MISCELLANEOUS MATERIALS

A. Miscellaneous Materials Include:

1. Miscellaneous metals for support of electrical materials and equipment.
2. Wood grounds, nailers, blocking, fasteners and anchorage for support of electrical materials and equipment.
3. Concrete bases for equipment.
4. Sealers for sealing around electrical materials and equipment; and for sealing penetrations in floors and walls.
5. Access panels and doors in walls, ceilings, and floors for access to electrical materials and equipment.

1.10 WARRANTIES

A. Refer to the Division 01 “Closeout Procedures” for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Divisions 26, 27 and 28 into a separated set of vinyl covered, three-ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, telephone numbers and procedures for filing a claim and obtaining warranty services.

D. Warranty requires correction of all work found to be defective or nonconforming to the Contract Documents, without cost to the Owner. Bear all costs associated with corrective measures and damage due to defects or nonconformance with the Contract Documents, excluding repairs required as a result of improper maintenance or operation, or normal wear and tear as determined by the Engineer.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS LUMBER

A. All lumber shall be fire-treated.

B. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative-treated in accordance with AWPB LP-2, and kiln-dried to a moisture content of not more than 19 percent.

2.2 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section “Penetration Firestopping.”

2.3 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. GPT Link-Seal

d. Metraflex Co.
e. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.
5. Place head end of bolts on accessible side of wall to allow for future adjustments.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time and recommended for interior and exterior applications.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounted items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right-of-Way: Give to piping systems installed at a required slope.

F. Jobsite Safety: The Contractor is the sole entity responsible for jobsite safety.

3.2 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of sealants and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Install equipment and materials in accordance with manufacturer instructions and the requirements in Section 20 0800 "Seismic Protection."

3.3 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Coordinate equipment rough-in requirements with Divisions 01 through 28.

3.4 ELECTRICAL INSTALLATIONS

A. Coordinate electrical equipment and materials installation with other building components.

B. Verify all dimensions by field measurements.

C. Arrange for chases, slots, and openings in other building components to allow for electrical installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.

E. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

F. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

G. Install systems, materials and equipment to conform to project requirements and approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.

H. Systems, materials and equipment which will be exposed in finished areas shall be installed level and plumb, parallel and perpendicular to other building systems and components.

I. Install electrical services and overhead equipment to provide the maximum headroom possible where mounting heights are not detailed or dimensioned.

J. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. Maintain code clearances in front of and about all electrical equipment. As much as practical, connect equipment for ease of disconnecting with minimum of interference with other installations.

K. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems and structural components.

L. Include in the Work all labor, materials, equipment, services, apparatus and drawings (in addition to the Contract Documents) as required to complete the intended Work.

M. Control and interlock wiring shall be installed in a separate raceway and shall not be installed in the same raceway as power conductors.

N. Only new, clean and perfect equipment, apparatus, materials and supplies of latest design and manufacture shall be incorporated in the Work in order to assure an electrical system of high quality.

O. The Work required in order to obtain utility services such as telephone and electric, is delineated in these specifications and on the drawings. Unless otherwise noted, construction or connection charges (except for temporary power) by those companies shall be paid by the Owner.

P. Determine electrical utility elevations prior to installation and coordinate with other trades. Installation priorities at a minimum shall be as follows:

1. Luminaires.
2. Gravity flow piping, including steam and condensate.
3. Electrical bus duct.
4. Sheet metal.
5. Cable trays, including access space.
6. Other piping.
7. Conduits and wireway.

3.5 CONNECTIONS TO EQUIPMENT AND APPLIANCES

A. In many instances the drawings show an outlet box and power supply for specific equipment, be it Owner- or Contractor-furnished. It is to be understood, unless otherwise noted, that the Work includes a connection from the box to the equipment or appliance. Verify circuit conductor quantities and sizes and overcurrent device number of poles and rating as well as any special grounding requirements, for all Owner-furnished equipment and adjust the required work accordingly.

B. Owner Furnished Equipment:

1. Install and connect Owner-supplied items electrical items indicated on Architectural Equipment Plans and Schedules even if not shown on the electrical plans. Connect all Owner-supplied items requiring electrical connections, whether or not shown on the electrical plans. Make all electrical system connections required for fully functional units.
2. The Owner will supply manufacturer’s installation data for new equipment purchased by owner for this project.
3. Repair all damage to Owner-furnished equipment caused during installation, to the satisfaction of the Owner.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit and place wood grounds, nailers, blocking and anchorage accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 APPLICATION OF SEALERS

A. General: Comply with sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

1. Comply with recommendations of ASTM C 962 for use of elastomeric sealants.

B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.9 INSTALLATION OF ACCESS DOORS

A. Set frames accurately in position and securely attached to supports with face panels plumb and level in relation to adjacent finish surfaces.

B. Adjust hardware and panels after installation for proper operation.

3.10 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Contract shall X-ray concrete slabs and walls prior to core drilling to avoid damage to utilities or reinforced steel.

D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.11 SLEEVE-SEAL INSTALLATION

A. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve.

B. Install to seal exterior wall penetrations.

C. Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. Provide insulated bushings at each end of sleeve. For sleeves through fire rated-wall or floor construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables.

1. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

3.12 FIRESTOPPING

A. Apply rated firestopping sealants at all penetrations of fire and smoke walls; at all penetrations of floors and at other locations as noted on the drawings or where required by Code. Consider walls that are common to different abutting buildings, to different additions to buildings, and to fire and smoke separations within buildings as requiring firestopping sealant. Refer to architectural drawings. For existing buildings where fire separations are not noted on any drawings, use reasonable logic as to which separations are fire-rated. When in doubt, consult with Engineer or Architect.

B. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.13 PAINTING

A. Paint all electrical equipment that is marred or damaged prior to the Owner’s acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.

B. Paint equipment, conduit, boxes, hangers, etc. as covered under Division 9.

C. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with based enamel finish coat free from scratches, abrasions, chipping, etc. Verify color preference with the Engineer before ordering equipment if a color option is specified.

3.14 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc., from all equipment.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

D. Refer to the Division 01 Section "Closeout Procedures" for general requirements for final cleaning.

3.15 SPECIAL REQUIREMENTS

A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.

B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement and orientation of equipment with the Owner's representative prior to setting equipment.

C. Include removal and reinstallation of equipment and devices if they were installed without regard to coordination of access requirements and without previous confirmation with the Owner's representative.

3.16 SYSTEM COMMISSIONING

A. The electrical systems shall be complete and operating. Include system start-up, testing, balancing and satisfactory system performance. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.

B. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls and alarms.

1. Utilize only skilled technicians to ensure that all systems perform properly. Reimburse the Owner on a time and materials basis for services rendered at the Engineer's standard hourly rates in effect when the services are requested if the Engineer is requested to visit the job site for troubleshooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation, workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design. Pay the Owner for services required that are project-, installation- or workmanship-related. Payment is due within 30 days after services are rendered.

3.17 FIELD QUALITY CONTROL

A. General:

1. All required equipment and systems tests shall be made during and post-Construction as required.
2. All required testing instruments, meters, etc., shall be provided.
3. Technicians operating testing equipment shall be trained in testing procedures.
4. Testing shall confirm that equipment and systems provided by the Contractor have been installed properly.
5. Unsatisfactory test results shall result in revisions or replacement of equipment or settings as required to provide a system capable of meeting test requirements. Tests shall be repeated or additional tests made as necessary to confirm system capability as required by the Owner, Engineer or Authority Having Jurisdiction.

3.18 OPERATION AND MAINTENANCE DATA

A. Refer to the Division 01 Section: “Closeout Procedures” for procedures and requirements for preparation and submittal of maintenance manuals.

B. In addition to the information required by Division 01 for Maintenance Data, include the following information:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions, regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventive maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

C. Submit three (3) properly indexed and bound copies in “D” ring style notebooks, of the Operations and Maintenance Instructions to the Architect or Engineer. Make all corrections or additions required.

D. Operation and Maintenance Instructions shall include:

1. Notebooks shall be heavy duty locking three-ring binders, black in color, and incorporate clear vinyl sheet sleeves on the front cover and spine for slip-in labeling. “Peel and stick” labels are not acceptable. Sheet lifters shall be supplied at the front of each notebook. Size notebooks a minimum of 1/2 inch thicker than the material for future inserts. Label the spine and front cover of each notebook. If more than one notebook is required, label in consecutive order. For example; 1 of 2, 2 of 2. No other forms of binding will be acceptable.
2. Prepare binder covers (front and spine) with printed title “Operation and Maintenance Instructions,” title of project, and subject matter of binder when multiple binders are required.
3. Title page with project title, Architect, Engineer, Contractor, and Subcontractor with addresses, telephone numbers, and contacts.
4. Table of Contents describing all index tabs.
5. Listing of all Subcontractors and major equipment suppliers with addresses, telephone numbers and contacts.

6. Index tabs dividing information by specification section, major equipment, or systems. All tab titles shall be clearly printed under reinforced plastic tabs. Label all equipment to match the identification in the construction documents.
7. Copies of warranties.
8. Copies of all final approved shop drawings and submittals. Copy of power system study and overcurrent protective device settings.
9. Copies of all factory inspections and or equipment start-up reports.
10. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
11. Dimensional drawings of equipment.
12. Detailed parts lists, each with a list of suppliers.
13. Operating procedures for each system.
14. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
15. Repair procedures for major components.
16. Replacement parts and service material requirements for each system and the frequency of service required.
17. Instruction books, cards, and manuals furnished with the equipment.

E. Operation and maintenance data shall consist of written instructions for the care, maintenance, and operation of the equipment and systems. Instruction books, cards, manuals furnished with the equipment shall be included.

F. In addition to the information required by Division 01 for Maintenance Data, include the following information:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions, regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventive maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

G. Adequately instruct the Owner’s designated representative in the maintenance, care, and operation of the complete systems installed under this contract.

H. Provide verbal and written instructions to the Owner’s representatives by factory personnel in the care, maintenance and operation of the equipment and systems.

I. Make DVD format compact disc of the instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video shall become the property of the Owner.

J. The instructions shall include:

1. Maintenance of equipment.
2. Start-up procedures for all major equipment.
3. Description of emergency system operation.

K. Notify the Engineer of the time and place for the verbal instructions to the Owner’s representative so his representative can be present if desired.

L. Minimum hours of instruction time for each item and/or system shall be as indicted in each individual specification section.

M. Operating Instructions:

1. Include instructions to the Owner's representatives for the electrical and specialized systems, using factory-authorized technical representatives.

3.19 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 01 Section "Closeout Procedures." In addition to the requirements specified in Division 01, indicate installed conditions for:

1. Raceways of 2-inches and larger, indicating size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Location of every home run point, such as receptacle, lighting fixture, or switch.
4. Approved substitutions, Contract modifications, and actual equipment and materials installed.
5. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; change orders; concealed control system devices.
6. Mark Specifications to indicate approved substitutions, change orders, actual equipment and materials used.

B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; Change Orders; concealed control system devices.

D. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. Mark all Change Orders, RFI responses, clarifications, and other supplemental instructions on the documents. Record documents that merely reference the existence of the above items are not acceptable. Reimburse the Engineer for all costs for the Engineer to develop record documents which comply with this requirement if unable to comply with said above requirements. Reimbursement shall be made at the Architect or Engineer's hourly rates in effect at the time of the work.

E. Record changes daily and keep the marked drawings available for the Architect or Engineer's examination at any normal work time.

F. Upon completing the job, and before final payment is made, give the marked-up drawings to the Engineer.

3.20 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 01:

B. Final Jobsite Observation:

1. Certify that the project jobsite is ready for the final jobsite observation.
2. Reimburse the Engineer, based on the Engineer’s standard hourly rates as defined in their contract with the Owner, for additional time and expenses when additional trips are required because the project jobsite was not ready for final observation and additional trips are required by the Engineer for review of final conditions.
3. Notify the Engineer a minimum of two working days prior to installation of ceiling tiles or lay-in ceilings to allow the Engineer to visit the project site.

C. Submit the following documents to the Architect or Engineer prior to requesting final payment:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including electronic AutoCAD or REVIT drawings and specifications.
3. Documentation of completion of all required training of Owner's personnel.
4. Provide spare parts, maintenance and extra materials in quantities specified in individual specification sections.
5. Inspection and testing reports.
6. Start-up reports on all equipment requiring a factory installation or start-up.

END OF SECTION 260500

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SECTION 260519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Conductors and Cables.
2. Metal Clad Cable (MC).

1.3 SUBMITTALS

A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not allow relief from full compliance with the contract documents.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 “National Electrical Code.”

1. Conform to applicable codes and regulations regarding toxicity of combustion products of insulating materials.

C. UL Compliance: Provide components which are listed and labeled by Underwriters Laboratories under the following standards.

1. UL Std. 83 Thermoplastic-Insulated Wires and Cables.
2. UL Std. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors.

D. NEMA and ICEA Compliance: Provide components which comply with the following standards:

1. WC-70: Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy.

E. IEEE Compliance: Provide components which comply with the following standard.

1. Std. 82: Test procedures for Impulse Voltage Tests on Insulated Conductors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Senator Wire & Cable Company.
4. Southwire Company.
5. Cerro Wire.
6. Superior Essex.
7. Encore Wire Corporation.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2 CONDUCTORS AND CABLES

A. General: Provide wire and cable suitable for the temperature, conditions and location where installed.

B. Feeders: Copper Copper for feeders smaller than No. 4 AWG; 600 volt insulation. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Branch Circuits: Copper, 600 volt insulation. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

D. Control Circuits: Copper, stranded conductor, 600 volt insulation.

E. Wire for the following specialized systems shall be as shown on drawings or as dictated within these specifications. Where not designated, the systems manufacturer’s recommendations shall be adhered to for the following systems:

1. Fire Alarm.
2. Low Voltage Switching.
3. Data.
4. Single Conductors for Feeders and Branch Circuits:
5. Stranding: Provide solid conductors for branch circuits and non-vibrating power utilization equipment utilizing Number 10 AWG and smaller. Provide stranded conductors for Number 8 AWG and larger. Provide stranded conductors, regardless of size, for connections to vibrating equipment such as motors and transformers.

F. General: Metal clad cables may be utilized for branch circuit wiring as defined in NFPA 70, Article 330 subject to acceptance by State and Local Codes.

G. Construction: Metal Clad cable to be a factory assembly of one or more individually insulated conductors enclosed in a metal sheath with armor ground. MC cable shall be listed and labeled under UL 1569.

H. Sheathing: Steel or aluminum interlocking tape, smooth tube or corrugated tube. Convolutions of interlocking tape shall not separate when cable is bent at a radius as tight as seven times the external diameter of the cable sheath.

I. Conductor Material: Copper, minimum 12 AWG.

J. Conductor Insulation: Minimum temperature rating of 90 degrees Celsius and of a type listed in NEC Table 310-13.

K. Metal clad cable shall **not** be used for circuits connected to the essential electrical system.

L. Approved use of metal clad cable is limited. Refer to Part 3 of this specification for permitted uses.

2.3 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type and class for application and service required.

PART 3 - EXECUTION

3.1 CONDUCTOR INSULATION, APPLICATIONS AND WIRING METHODS

A. Concealed in Ceilings, Walls, Partitions, Raised Flooring and Crawlspaces: Type THHN-THWN, single conductors in raceway.

B. Concealed in Concrete, below Slabs-on-Grade and Underground: Type THWN, single conductors in raceway.

C. Exposed, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

E. Class 1 Control Circuits: Install per NEC Article 725.

F. Class 2 Control Circuits: Install per NEC Article 725.

3.2 DEVIATION FROM CONTRACT DRAWINGS

A. Basis of Design is copper conductors installed in raceway, based on 30 degrees C ambient temperature (NEC Table 310.15(B)(16)). If materials or methods selected for installation differ from the basis of design, size conductors and conduits to meet or exceed the ampacity of circuits selected for the basis of design.

B. Routing multiple conductors within a single conduit requires the conductor ampacity to be derated per National Electrical Code Article 310. Do not provide more than 4 conductors within a single conduit to serve loads such as panelboards, motor control centers, motors over 1/4 horsepower, etc.

C. Underground duct conductor ampacity is based on table B.310.15(B)(2)(7) of the National Electrical code, or has been calculated in accordance with Informative Annex B: Application Information for Ampacity Calculation. Deviation from the contract documents in regards to conductor and conduit quantities or orientation shall require supporting calculations and a sketch for Engineer approval.

D. Where ungrounded conductors are increased in size for any reason, equipment grounding conductors shall be increased in size proportionally according to the circular mil area of the ungrounded conductors.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Install products in accordance with manufacturer's instructions.

B. Conceal cables in finished walls, ceilings and floors unless otherwise indicated.

C. Completely and thoroughly swab raceway before installing wire.

D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

E. Use pulling means including fish tape, cable, rope, and basket weave wire and cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable. Do not exceed maximum tensile strength of conductor or grip. Do not exceed maximum sidewall pressure limitations of cables.

F. Pull conductors simultaneously where more than one is being installed in the same raceway.

G. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

H. Feeder conductors shall be continuous and shall not contain splices.

I. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than Number 10 AWG cabled in individual circuits. Make terminations so there is no more than 1/8 inch of exposed bare conductor at the terminal. Observe NEC 310.15 (B)(2)(a) adjustment factors.

J. Verify that interior of building has been protected from weather and mechanical work likely to damage wire and cable has been completed prior to installing wire and cable.

K. Use conductor not smaller than Number 12 AWG for power and lighting circuits.

L. Single conductors used for control circuits shall not be smaller than Number 14 AWG.

M. Use Number 10 AWG conductors (phase, neutral and ground) for 20 ampere, 120 volt branch circuits longer than 75 feet, unless drawings requirements are more stringent.

N. Use Number 10 AWG conductors (phase, neutral and ground) for 20 ampere, 277 volt branch circuits longer than 200 feet, unless drawings requirements are more stringent.

O. Use Number 8 AWG conductors (phase, neutral and ground) or larger for outdoor lighting circuits.

P. Place an equal number of conductors for each phase, neutral and ground of a circuit within the same raceway or cable when routing parallel conductors. Conductor lengths must be equal.

Q. Support cables according to Division 26 Section "Hangers and Supports."

R. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CABLE INSTALLATION, APPLICATIONS AND WIRING METHODS

A. Open cabling shall be routed in a symmetrical manner, tight and parallel to walls.

B. Support open cable by appropriate size bridle rings or j-hooks at five foot intervals. Open cable may not rest on suspended ceilings. Wire and cable from different systems shall not be installed within the same bridle rings or j-hooks. Neatly bundle grouped cables every two-and-a-half feet with a nylon tie wrap.

C. Open cable may only be installed where specifically dictated on drawings or permitted elsewhere within these specifications.

3.5 METAL CLAD CABLE INSTALLATION

A. Metal clad cable will be allowed for lighting in accessible ceiling spaces or where fished into existing walls for 20A and 15A branch circuits. Metal clad cable shall not be installed horizontally within any wall. Metal clad cable lengths are subject to Owner approval.

B. Metal clad cables may be utilized for 20A and 15A branch circuit wiring as defined in NFPA 70, Article 330 and Article 517 subject to acceptance by State and Local Codes. Feeder wiring must consist of individual insulated conductors in conduit.

C. Metal clad cable installations shall comply with the requirements stipulated within Article 330 of the National Electrical Code.

D. Provide individual insulated conductors in conduit from branch panelboard to junction box(es) located above the ceiling in the same room as the final device(s) or luminaire(s) being served.

1. Metal clad cable is permitted to be extended from this junction box to electrical devices and luminaires in the same room where all other requirements of this specification are met. Horizontal length of HCF metal clad cable extending from the local room junction box to the final in-wall device shall not exceed 25 feet.

2. In rooms or spaces with inaccessible ceilings, the aforementioned junction box may be located in the nearest accessible ceiling, corridor preferred.

E. Metal clad cable is allowed for flexible connection to luminaires in lengths not to exceed 6’-0”.

F. Metal clad cable is allowed for branch circuits of 30 amperes and less when run from a junction box located above an accessible ceiling, within 8 feet of the partition containing the served wiring device box (or within 6 feet of a lighting fixture). Wiring between the above junction box and the panelboard shall consist of individual conductors in conduit.

G. Metal clad cable shall only be run concealed.

H. Metal clad cable shall not be daisy chained from receptacle-to-receptacle or from luminaire to luminaire. Metal clad cable runs shall be from a junction box to the final device or luminaire.

I. Metal clad cable shall **not** be used for circuits serving the Essential Electrical System.

3.6 CONNECTIONS AND TERMINATIONS

A. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A.

B. Clean conductor surfaces before installing lugs and connectors.

C. Utilize solderless compression terminals applied with circumferential compression for conductor sizes 8 AWG and larger and crimp in accordance with manufacturer instructions. Indenter compression method may be used for conductor sizes 10 AWG and smaller.

D. Phase Sequence: Connections to phase conductors at electrical equipment shall be made such that the A-B-C conductors, when facing the equipment, are oriented top to bottom, or left to right.

E. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.7 SPLICES AND TAPS

A. Conductor splices shall be kept to a minimum.

B. Only splice within accessible junction boxes or enclosures.

C. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors. Splices and taps shall be capable of carrying the full ampacity of the conductors without perceptible temperature rise.

D. Above Grade:

1. Use copper compression connectors applied with circumferential compression for conductor sizes 6 AWG and larger.
2. Use pre-molded insulated tap connectors for copper conductor splices and taps, Number 8 AWG and smaller. Insulate with UL listed insulating cover supplied by same manufacturer as connector.

3. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, Number 10 AWG and smaller.
4. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor, or three layers of tape, whichever is greater.

E. Below Grade:

1. Use specified insulated connectors suitable and approved for below grade wiring connectors. Ensure that conductors do not apply tension to splice.

3.8 FIELD QUALITY CONTROL

A. Inspect wire for physical damage and proper connection.

B. Measure tightness of bolted connections with properly scaled and calibrated torque tool and compare torque measurements with manufacturer's recommended values.

C. Before energizing, test wires and cables for electrical continuity and for short circuits.

D. Remove and replace malfunctioning conductors and retest as specified above.

END OF SECTION 260519

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SECTION 260529 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals and associated fastenings.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

D. RNC: Rigid non-metallic conduit.

E. Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of four times the applied force.

1.4 SUBMITTALS

A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not allow relief from full compliance with the contract documents.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Electrical components shall be listed and labeled for the specific intended purpose by Underwriters Laboratories, Inc.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 COORDINATION

A. Coordinate size, shape and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Slotted Metal Angle and U-Channel Systems:
2. Allied Tube & Conduit.
3. American Electric.
4. B-Line Systems, Inc.
5. GS Metals Corp.
6. Unistrut Diversified Products.
7. Conduit Sealing Bushings:
8. Bridgeport Fittings, Inc.
9. Killark Electric Mfg. Co.
10. O-Z/Gedney.
11. Raco, Inc.
12. Red Seal Electric Corp.

2.2 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish or inherent material characteristic.

2.3 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets and spring steel clamps.

B. Fasteners: Types, materials and construction features as follows:

1. Expansion Anchors: Carbon steel wedge or sleeve type.
2. Toggle Bolts: All steel springhead type.
3. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.

C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps and cap screws.

D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

E. U-Channel Systems: 16-gauge steel channels, with 9/16-inch-diameter holes, between one and one half and two and one half inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

2.4 FABRICATED SUPPORTING DEVICES

A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves:

1. Provide pipe sleeves of one of the following:
2. Interior Dry Locations: Fabricate from Schedule 40 galvanized steel pipe or Schedule 40 PVC plastic pipe.
3. Exterior or Interior Wet or Damp Locations: Fabricate from Schedule 40 PVC plastic pipe.
4. Sleeves shall not penetrate structural members without approval from the Structural Engineer.
5. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
6. Install all sleeves concentric with conduits. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
7. Where conduits rise through concrete floors that are on earthen grade, provide 3/4-inch resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
8. Size sleeves large enough to allow expansion and contraction movement.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Coordinate with the building structural system and with other disciplines' installations.

C. Raceway Supports: Comply with the NEC and the following requirements:

1. Conform to manufacturer's recommendations for selection and installation of supports.
2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 pounds safety allowance in the strength of each support.
3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
4. Support parallel runs of horizontal raceways together on trapeze-type hangers.

5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-inch and smaller raceways serving branch circuits, telephone and data above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
6. Space supports for raceways in accordance with Table I of this section. Space supports for raceway types not covered by the above in accordance with NEC.
7. Support exposed and concealed raceway within 3 feet of boxes, access fittings, device boxes or cabinets.
8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway or conductor terminals.
9. Vertical Conductor Supports: Install simultaneously with installation of conductors.
10. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers and other devices.

D. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, motor control centers, disconnect switches and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4-inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
3. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment or conduit unless otherwise noted.
4. Do not use powder-actuated anchors without specific permission.
5. Do not drill structural steel members.
6. Install surface-mounted cabinets and panelboards with minimum of four anchors.
7. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

E. In wet locations and on all building floors below exterior earth grade install freestanding electrical equipment on concrete pads.

F. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.2 PAINTING

A. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

TABLE I: SPACING FOR RACEWAY SUPPORTS

			Maximum Spacing of Supports (Feet)		
Raceway Size (Inches)	**No. of Conduits in Run**	**Location**	**RMC & IMC***	**EMT**	**RNC**
HORIZONTAL RUNS					
1/2, 3/4	1 or 2	Flat ceiling or wall.	5	5	3
1/2, 3/4	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	7	7	--
1/2, 3/4, 1	3 or more	Any location.	7	7	--
1 & larger	1 or 2	Flat ceiling or wall.	6	6	--
1 & larger	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	10	10	--
1 & larger	3 or more	Any location.	10	10	--
Any	--	Concealed.	10	10	--
VERTICAL RUNS					
1/2, 3/4	--	Exposed.	7	7	--
1, 1-1/4	--	Exposed.	8	8	--
1-1/2 and larger	--	Exposed.	10	10	--
Up to 2	--	Shaftway.	14	10	--
2-1/2	--	Shaftway.	16	10	--
3 & larger	--	Shaftway.	20	10	--
Any	--	Concealed.	10	10	--

*Maximum spacings for IMC above apply to straight runs only. Otherwise the maximums for EMT apply.

END OF SECTION 260529

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SECTION 260533 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following raceways electrical wiring:

1. Metallic Conduit and Tubing.
2. Metal Wireways.
3. Surface Raceways.
4. Low Voltage Cabling Support.
5. Communications Raceway Accessories.

1.3 SUBMITTALS

A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not allow relief from full compliance with the contract documents.

B. Product Data: For surface raceways, wireways and fittings, hinged-cover enclosures, and cabinets.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 "National Electrical Code" for components and installation.

C. Comply with NECA "Standard of Installation."

D. Listing and Labeling: Provide products specified in this Section that are listed and labeled by Underwriters Laboratories for the specific purpose and comply with the following standards:

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
3. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
4. ANSI C80.6 – Intermediate Metal Conduit, Zinc Coated.
5. ANSI/NFPA 70 - National Electrical Code.

6. ANSI/NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable.
7. NECA "Standard of Installation."

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements, and comply with applicable portions of NFPA 70 for raceways.

B. Bushings: Bushings for terminating conduits smaller than 1-1/4 inches are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation. Install insulated type bushings for terminating conduits 1-1/4 inches and larger. Upper edge to have phenolic insulating ring molded into bushing. Bushings to have screw type grounding terminal.

2.2 METAL CONDUIT AND TUBING

A. Electrical Metallic Tubing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Allied Tube & Conduit.
3. Republic Conduit.
4. Wheatland Tube Company.
5. Description: Conduit to be seamless, hot dipped or electro-galvanized steel tubing. Galvanizing to provide zinc coating fused to outside walls of conduit. Provide an enamel lubricating coating on the inside of the conduit. Conduit to conform to ANSI C80.3 - 1983 and listed and labeled under UL 797.
6. Fittings and Conduit Bodies: Compression.
7. Expansion fittings for use with EMT shall allow for a minimum of four inches of movement and shall be similar to O-Z Gedney TX series, complete with bonding jumpers and hardware.

B. Flexible Metal Conduit: Zinc-coated steel or aluminum.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. AFC Cable Systems.
3. Alflex Inc.
4. Electri-Flex Co.
5. Description: Interlocked steel or aluminum construction, consisting of spirally wrapped, convoluted hot dip galvanized steel strip. Zinc coating to cover both sides and all edges of steel strip. Convolutions to be interlocked to prevent separation when conduit is bent at radius equal to 4-1/2 times conduit O.D. Conduit to be listed and labeled under UL 1.

6. Fittings: ANSI/NEMA FB 1 -1988. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron or screw-in type, die cast zinc

C. Liquidtight Flexible Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. AFC Cable Systems.
3. Alflex Inc.
4. Electri-Flex Co.
5. Description: Flexible steel conduit with PVC jacket, listed and labeled under UL 360
6. Fittings: and Conduit Bodies: Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron. Conduit to be listed and labeled under UL 360.

2.3 METAL WIREWAYS

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

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 12, or 3R as environmental conditions dictate, unless otherwise indicated.

C. Material: Primed and painted sheet steel for indoor locations, galvanized sheet steel for outdoor locations sized as indicated or required, whichever is greater.

1. Wireway up to 6 inch by 6 inch cross section shall be minimum 16 gage.
2. Wireway larger than 6 inch by 6 inch cross section shall be minimum 14 gage.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

E. Wireway Covers: Hinged. Utilize flanged-and-gasketed type for outdoor locations.

F. Finish: Manufacturer's standard gray enamel finish.

2.4 LOW VOLTAGE CABLING SUPPORT

A. General: The following supporting products are for use in systems below 50V.

B. Open top cable supports (J-Hooks):

1. Galvanized steel construction with smooth rounded edges.
2. Complies with UL, cUL, NEC, and ANSI/TIA/EIA requirements for structured cabling systems.
3. Manufacturers:
4. Erico.
5. B-Line.
6. Panduit.

2.5 COMMUNICATIONS RACEWAY ACCESSORIES

A. Pull cords:

1. Pull wires shall be nylon type.
2. Provide in all empty conduits, sleeves, raceways and all cabling pathways for future use.
3. Pull cords shall have a tensile rating of 200 pounds minimum.

PART 3 - EXECUTION

3.1 METALLIC CONDUIT APPLICATION

A. The following schedule shall be followed for all installations, unless it creates a violation of applicable codes or is otherwise specifically dictated otherwise within the drawings.

1. Indoor Locations:
2. Exposed, not subject to physical damage, or above 7 feet-0 inches of finished floor: RMC, IMC or EMT.
3. Exposed, subject to physical damage, or within 7 feet-0 inches of finished floor: RMC, IMC.
4. Finished spaces, concealed above suspended ceilings and interior walls and partitions: EMT.
5. Wet or Damp Locations: RMC or IMC.
6. Connections to vibrating equipment: FMC, except use LFMC in wet or damp locations.

B. Conduit Size:

1. Conduits shall be sized as shown on drawings. Where conduit sizes are not indicated, conduits shall be sized in accordance with the latest version of the National Electrical Code (NFPA 70) and shall be limited to a 40 percent conductor fill percentage. Conductor ampacities must be maintained; therefore adjustment factors for temperature and quantity derating values must be observed.
2. Minimum Conduit Size: Unless otherwise noted, 3/4-inch (21-mm) trade size with the following exceptions:
    1) Switchlegs, Luminaire Whips and Control Wiring: 1/2-inch.
    2) Below Grade: 1-inch.

3. Conduit sizes may change only at the entrance or exit of a junction box.

3.2 METALLIC CONDUIT INSTALLATION

A. General Installation Requirements

1. Conduits shall be mechanically and electrically continuous from source of current to all outlets unless a properly sizes grounding conductor is routed within the conduit. All metallic conduits shall be bonded per NFPA 70.
2. Do not reduce the indicated sizes of raceways. Conduit sizes may only change junction and pull boxes.
3. Complete raceway installation before starting conductor installation.
4. Use temporary closures to prevent foreign matter from entering raceway.
5. Avoid moisture traps; provide junction box with drain fitting at low points in raceway system.
6. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Empty raceways shall be labeled at each end indicating origin of the raceway. Labels shall be self-adhesive vinyl labels.

B. Conduit Routing:

1. Conduit shall be concealed in walls and above ceilings within finished spaces and may be exposed within unfinished spaces (such as mechanical and utility areas) where conditions dictate and as practical. Where routed exposed, headroom shall be maintained for pedestrian and vehicular traffic.
2. Raceway routing proposed on Drawings is diagrammatic in nature and shown in approximate locations unless dimensioned. Coordinate conduit routing with beams, joists, columns, windows, etc., as required to complete wiring system. Verify field measurements, routing and termination locations of raceway with obstructions and other trades prior to rough-in.
3. Conduit installation shall be coordinated with all other systems on the project. The Construction Team shall exchange details of their work in order to ensure adequate and coordinated fit of all systems within ceiling spaces and exposed unfinished areas.
4. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions, except as otherwise indicated.
5. Route exposed conduit and conduits above ceilings parallel and perpendicular to building structural lines, and as close to building structure as possible.
6. Raceways are not to cross pipe shafts or ventilating duct openings, nor are they to pass through HVAC ducts. Support riser raceway at each floor level with clamp hangers. Maintain adequate clearance between raceway and piping.
7. Coordinate layout and installation of conduit with other construction elements to ensure adequate headroom, working clearance and access.
8. Route conduit through roof openings provided for piping and ductwork or rooftop unit curbs where possible. Where unavoidable, route conduit through suitable roof jack with pitch pocket. Coordinate roof penetrations with other trades.
9. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
10. Do not install aluminum conduits in contact with concrete.
11. Raceways routed under-slab on grade must be a minimum of 12 inches below the concrete slab.

C. Conduit Supports:

1. Install raceways level and square and at proper elevations. Provide adequate headroom. Group related conduits; support using conduit rack. Construct rack using steel channel. All conduit supports shall be secured to walls, structural members, and bar joists. Do not support conduits from non-structural members, such as ductwork, water or fire suppression piping, or ceiling grid support system.
2. Run parallel or banked raceways together, on common support racks where practical and make bends from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways. Provide space within each rack for 20 percent additional conduits.
3. Support raceways as specified in Division 26 Section "Hangers and Supports."

D. Conduit Fittings and Terminations:

1. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
2. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
3. Install raceway sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank

coverplate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings where conduits enter or leave hazardous locations, where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces, such as kitchen cold boxes, air-conditioned spaces and other places indicated on the drawings or required by NFPA 70.

4. Expansion/Deflection Joints: Provide suitable fittings to accommodate expansion and contraction where raceway crosses seismic and expansion joints. Install expansion fittings in the full open position if installed during a period of lowest expected temperature, and in the fully closed position if installed during a period of highest expected temperature. Install at proportionate intermediate position for intermediate temperatures.
5. In addition to the foregoing, provide expansion fittings according to the following table, for exposed linear runs or runs in hung ceilings where such runs do not contain junction boxes, pull boxes, nor bends totaling more than 30 degrees.
6. EMT and RMC expansion couplers shall be UL listed with an internal copper braided bonding jumper that meets the requirements of NEC 250.98. Fitting shall be listed as suitable for wet locations and rain water tight when installed in wet or outdoor locations.

Raceway Material	Indoor, conditioned areas	Outdoors and non-conditioned areas
Steel	One expansion fitting in runs longer than 80 feet, additional expansion fittings every 400 feet	One expansion fitting in runs longer than 40 feet, additional expansion fittings every 200 feet
PVC	One expansion fitting in runs longer than 20 feet, additional expansion fittings every 100 feet	One expansion fitting in runs longer than 10 feet, additional expansion fittings every 50 feet

7. Flexible Connections: Use maximum of 6 feet of flexible metal conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement and for all motors. Use Liquidtight flexible metal conduit in wet or damp locations. Install ground conductor across flexible connections.
8. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.

E. Conduit Bends:

1. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
2. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.
3. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender when field-fabricated elbows are required for bends in metal conduit larger than 2 inch size.
4. Stub-Up Connections: Use type of conduit described for stub-ups from slab. Extend conduit through concrete floor for connection to freestanding equipment to a distance 6-inches above the floor. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

3.3 WIREWAY INSTALLATION

A. Wireway shall be securely fastened to walls using steel channels. Mount plumb and level.

B. Raintight wireways may only be installed in horizontal orientations.

3.4 COMMUNICATIONS RACEWAY INSTALLATION REQUIREMENTS

A. General:

1. These guidelines are intended to supplement the requirements listed in other portions of this specifications section.
2. Minimum raceway size shall be as necessary to comply with fill ratio of referenced standards, but in no case less than 1-1/4 inch.
3. Provide specified pull wires in all cabling pathways.
4. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end.
5. Ground and bond all systems in accordance with the NEC and ANSI/TIA/EIA 607.
6. All installation material and practices shall fully comply with NFPA 70 “National Electrical Code” and ANSI/TIA/EIA 569A Commercial Building Standard for Telecommunications Pathways and Spaces (BICSI).
7. Coordinate work with the building structural systems and electrical installation.
8. All work shall fully comply with these Specifications and related Drawings and all manufacturers’ recommended installation practices.
9. Do not install conduit in concrete slab.
10. There shall not be more than the equivalent of 180 degrees of bends in any single run of conduit between adequately sized pull.
11. Conduits entering a Telecommunications room below the finished ceiling shall be extended a minimum of 4-inches below the ceiling, and shall be routed as tight to the adjacent wall as possible.
12. Conduits entering a Telecommunications room through a wall shall extend 15 inches into the room and kept a minimum of 8 feet above finished floor.
13. Conduit bends:
14. Bends shall be made so that the conduit will not be flattened or kinked and the internal diameter of the conduit will not be reduced.
15. The radius of the curve of the inner edge of any bend shall not be less than as indicated by the National Electrical Code and ANSI/TIA/EIA 569A Commercial Building Standard for Telecommunications Pathways and Spaces.
16. In no case shall any conduit be bent or any fabricated elbow be applied to less than the allowable bending radius as specified by the cable manufacturer of the installed conductor.
17. When necessary to make field bends, use tools designed for conduit bending. Heating of metallic conduit to facilitate bending is not permitted.
18. A conduit run shall not be longer than 100 feet between pull boxes for conduit runs inside a building.
19. Do not cut, burn or drill any structural member to mount electrical equipment or to facilitate tray or conduit installations without having previously received approval, in writing, from the Architect/Engineer/Consultant.
20. Mount all conduit a minimum of 3 inches above any accessible type ceiling.
21. Maintain conduit runs at least 6 inches from insulate pipes, steam lines or any other hot pipes they pass. Where the lines are not insulated, the clearances shall be increased until the temperature of the conduit, with no live conductors enclosed, does not rise above the ambient temperature of the installation area.

B. Communications Pathway Separation Requirements:

1. Provide separation of communications pathways to minimize the effects of electromagnetic interference (EMI) by installing pathways in the following manner:
2. Provide a minimum of 12 inches separation from power lines exceeding 5kV and communications pathways not concealed in metallic conduit.
3. Provide a minimum of 6 inches separation from power lines exceeding 5kV and communications pathways concealed properly bonded in metallic conduit.
4. Provide a minimum of 37 inches separation from electrical motors and transformers and communications pathways.
5. When power lines or cables of different signal conditions must intersect, crossing shall be made at 90 degree angle, with proper separation as outlined above.

C. Open Top Cable Supports (J-Hooks):

1. Install J-hook pathway, supporting at least every 5 feet, as straight as possible parallel and/or perpendicular to building structure.
2. Shall be mounted to building structure or suspended by threaded rod from the deck above approximately 6 inches above suspended ceiling.
3. Attachment of J-hooks must be to building structure directly or utilize a minimum of 1/4 inch all-thread rod anchored into deck above.
4. Bundle cables with Velcro cable straps per TIA 596C and at each directional change.
5. Under no condition shall there be more than 12 inches of vertical cable sag between supports.
6. Cinch-tight cable ties are prohibited for all low voltage cabling support.
7. Cable routes of less than ten 4 pair UTP (or equivalent weight) may be supported with bridal rings at maximum 5 feet-0 inch intervals.
8. During installation of cables thru open top cable supports, pulling tension of cables shall not exceed 25 lbs.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.6 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.7 CLEANING

A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches and abrasions.

3.8 MARKING AND IDENTIFICATION

A. Mark and identify conduits in accordance with Section 26 0553 “Identification for Electrical Systems.”

3.9 RECORD DOCUMENTS

A. Accurately record actual routing of all feeder and sub-feeder conduits regardless of size and branch circuits conduits larger than 2-inches.

END OF SECTION 260533

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SECTION 260553 - 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. Identification for raceways.
2. Identification for wires, cables, and conductors.
3. Warning labels and signs.
4. Instruction signs.
5. Miscellaneous identification products.

1.3 SUBMITTALS

A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not allow relief from full compliance with the contract documents.

B. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with the following standards:

1. ANSI A13.1 and IEEE C2.
2. NFPA 70.
3. 29 CFR 1910.144 and 29 CFR 1910.145.
4. ANSI Z535.4 for safety signs and labels.

B. 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 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Electromark - Wolcott, New York.
2. Ideal Industries, Inc.
3. 3M.
4. Panduit Corp.
5. Seton Name Plate Co.
6. Thomas & Betts.
7. W. H. Brady, Co. - Signmark Division - Milwaukee, Wisconsin.

2.2 ELECTRICAL IDENTIFICATION PRODUCTS

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

B. Self-Adhesive Vinyl Tape for Banding (Raceway, Wire and Cable): Colored, heavy duty, waterproof, fade resistant; 2 inches wide.

C. Self-Adhesive Tape Markers (Wire and Cable): Vinyl or vinyl-cloth, self-adhesive, wraparound, cable and conductor markers with preprinted numbers and letters.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

E. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

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

F. Snap-Around, Color-Coding Bands (Raceways and Cables): Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

G. Colored Adhesive Marking Tape (Raceways, Wires, and Cables): Self-adhesive plastic coated cloth tape similar to Brady 441XX or 442XX series.

H. Conductor Identification Products:

1. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
2. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application with 1/4-inch (6.4-mm) grommets in corners for mounting, nominal 7 by 10 inches in size unless noted otherwise.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. Provide 1/4-inch (6.4-mm) grommets in corners for mounting, nominal 10 by 14 inches in size unless noted otherwise.

E. Plasticized Card Stock Tags: Vinyl cloth with preprinted and field-printed legends to suit the application. Orange background, except as otherwise indicated, with eyelet for fastener.

F. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in black letters on white face and punched for mechanical fasteners.

2.4 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Overlay shall provide a weatherproof and UV-resistant seal for label. Labels shall be at least 2-1/4 inches high. Where space does not permit this label size, smaller stock and lettering is permitted.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with lettering and background colors as indicated. Labels shall be at least 2-1/4 inches high. Where space does not permit this label size, smaller stock and lettering is permitted.

C. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Labels shall be at least 2-1/4 inches high. Where space does not permit this label size, smaller stock and lettering is permitted.

2.5 CABLE TIES

A. Cable Ties: Fungus-inert, self-extinguishing, nylon one-piece, self-locking cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a minimum temperature range from minus 50 degrees F to 350 degrees F. Provide ties in specified colors when used for color-coding.

B. Identification Cable Ties: Same as "Cable Ties" above, except with integral tab of suitable size for marking requirements.

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). Comply with maximum volatile organic compound levels imposed within Division 09.

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. Increase size of labels and letters to those appropriate for viewing from the floor for elevated components.

C. Lettering and Graphics: Coordinate names, abbreviations, colors and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering and colors as required by code.

D. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.

E. Clean and degrease surfaces prior to applying identification products. Apply identification to surfaces that require finish after finish work is completed. Utilize primer for metal surfaces, heavy-duty acrylic resin block filler for concrete masonry, and clear alkali-resistant alkyd binder-type sealer for concrete surfaces.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. 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 (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

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

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.2 LABEL COLOR CODE LEGEND

A. Provide the following color coding scheme for each label based on the power system it is identifying:

1. Normal Power: Black letters on white background.
2. Life Safety Power: White letters on green background.

3.3 RACEWAY IDENTIFICATION

A. Identify Raceways of Certain Systems with Color Banding: Band exposed and accessible raceways of the following systems for identification. Bands shall be pre-tensioned, snap-around colored plastic sleeves, colored adhesive marking tape, or a combination of the two. Make each color band 2 inches wide, completely encircling conduit and place adjacent bands of two-color markings in contact, side by side. Install bands at changes in direction, at penetrations of walls and floors and at 20-foot maximum intervals in straight runs. Apply the following colors:

1. Primary Distribution System: Grey.
2. Normal Distribution System (480/277V): Orange.
3. Normal Distribution System (208/120V): White.
4. Emergency Distribution System (480/277V): Orange/Yellow Bands.
5. Emergency Distribution System (208/120V): White/Yellow Bands.
6. Ground: Green.
7. Fire Alarm System: Red.
8. Temperature Controls/Building Automation: Blue.
9. Telecommunications: Blue/White Bands.
10. At contractor option, manufacturer painted EMT conduit (when EMT conduit is allowed or required to be used for the above systems), may be utilized in lieu of the banding noted above. Fittings would not have to be painted. All painting shall comply with Division 09 requirements.

B. Where conduits leave a switchboard, panelboard, motor control center, etc., identification shall be provided on each conduit indicating the load being served.

C. Contractor shall be responsible for providing the Owner with laminated, colored, typewritten legends indicating the identification color scheme. At a minimum, these legends should be installed in the main electrical room and branch electrical closets. Provide two additional legends to the Owner to use at their discretion.

D. Identification of Raceways with Labeling:

1. Raceway Labeling: Provide labeling on conduits indicating electrical distribution system contained within (e.g. Normal, Life Safety, etc.) and operating voltage level. Label size shall be as follows:

Nominal EMT conduit size	Nominal RGS conduit size	Length of color background on label	Height of letters
up to 1 inch	up to 3/4 inch	8 inches	1/2 inch
1.25 to 1.5 inches	1 to 1.5 inches	8 inches	3/4 inch
2 to 5 inches	2 to 5 inches	12 inches	1.25 inches
6 inches	6 inches	24 inches	2.5 inches

2. Raceways carrying circuits over 600V: Provide label with 3-inch (75mm) high letters on 20-inch (500mm) centers to read as follows: "DANGER CONCEALED HIGH VOLTAGE WIRING."

3.4 BOX IDENTIFICATION

A. Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage:

1. Normal Power.
2. Emergency Power.

B. At each junction, pull and connection box, identify the following: with self-adhesive vinyl labels or permanent marker (color coded) neatly hand-printed. Identification of these boxes shall be located on the inside of cover if located in finished spaces:

1. Power and lighting circuits: Indicate system voltage and identify contained circuits and panelboard serving load (e.g., “120V, PP1-1, 3, 5”).
2. Other wiring: Indicate system type and wiring description (e.g., “FIRE ALARM NAC #2”).

C. Paint box covers to correspond with system types as follows:

1. Fire Alarm: Red.
2. Temperature Control/Building Automation System: Blue.
3. Optional Emergency Branch: Yellow.

3.5 CIRCUIT IDENTIFICATION

A. Label conductors as follows:

1. Multiple Power or Lighting Circuits in the Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications signal/wiring, use wire/cable marking tape at terminations in wiring boxes, troughs and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.

3.6 CONDUCTOR COLOR CODING

A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, panelboards, manholes, handholes, switches, etc., use color-coding conductor tape to identify the phase.

1. Color-Coding for Conductors rated 600 V or Less: Use colors listed below for all conductors.

a. Color shall be factory-applied, or field-applied for sizes larger than No. 6 AWG, if Authorities Having Jurisdiction permit

1) Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) 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.

b. Colors for 208/120V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral: White.
5) Ground Bond: Green.

c. Colors for 480/277V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral: Gray.
5) Ground Bond: Green.

B. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control and signal connections.

1. Identify conductors, cables and terminals in enclosures and at junctions, terminals and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

C. Open Cable Identification

1. Low Voltage Cable (Less than 120V): Provide self adhesive pre-printed vinyl tape markers at 20 foot intervals to identify all cables run exposed or located above the accessible ceilings. Indicate the associated system by using the following color coding schemes:

a. Fire Alarm: Red lettering on white background.
b. Temperature Controls: Blue lettering on white background.
c. Security System: Black lettering on white background.
d. Telephone System: White lettering on blue background.

3.7 RECEPTACLE IDENTIFICATION

A. Identification Material: Pre-printed, self-laminating vinyl labels, 3/16-inch font height. Utilize black lettering on clear background for normal power circuits.

B. Coverplates: Provide identification on all receptacle coverplates indicating the source panelboard and circuit number serving the device (e.g., PP1#1).

END OF SECTION 260553

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SECTION 260600 - ELECTRICAL DEMOLITION

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. Electrical coordination, materials and methods for electrical demolition associated with remodeling of an existing area or facility for re-use.

1.3 SELECTIVE DEMOLITION

A. This Section includes limited scope general construction materials and methods for application with electrical installations as follows:

B. Selective demolition including:

1. Nondestructive removal of materials and equipment for reuse or salvage as indicated.
2. Dismantling electrical materials and equipment made obsolete by these installations.
3. Miscellaneous metals for support of electrical materials and equipment required to remain.
4. Firestopping as required to maintain existing partition ratings.

1.4 PROJECT CONDITIONS

A. Conditions Affecting Selective Demolition: The following project conditions apply:

1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
2. Locate, identify and protect electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
3. Maintain and protect existing building services that transit the area affected by selective demolition.

1.5 SEQUENCE AND SCHEDULING

A. Coordinate the shut-off and disconnection of electrical, fire alarm and communication services with the Owner and the utility companies. Coordinate any electrical outages required for service

switchovers or connections with the Owner a minimum of five working days prior to the interruption. Comply with Owner's specific requirements for partial or complete outage requests.

B. All work that produces excessive noise and/or interference with normal building operations, as indicated on the drawings, shall be coordinated and scheduled with the Owner.

C. Assume that all required re-connection of existing systems or equipment not indicated for demolition must remain operational unless otherwise noted. Provide temporary connections to maintain electrical services and systems serving adjacent areas during required outages.

D. Maintain existing electrical service, electrical distribution, fire alarm and communication equipment in operation until the new electrical service or distribution equipment is energized, tested and accepted.

1.6 DRAWINGS AND SPECIFICATIONS

A. The architectural, structural, mechanical and electrical drawings and specifications shall be considered as mutually explanatory and complementary. Any electrical demolition work called for by one and not by the other shall be performed as though required by all. All sections and subsections of the Electrical work shall be governed by and subject to the general and supplementary conditions. Any discrepancies in or between the drawings and specifications, or between the drawings and actual field conditions shall be reported to the Engineer/Architect in sufficient time to issue an addendum for clarification.

B. The electrical drawings are diagrammatic and the drawings indicate the general layout of the electrical systems. Field verification of scale dimensions on plans is directed since actual locations, distance and levels will be governed by actual field conditions.

PART 2 - PRODUCTS

2.1 MATERIALS AND METHODS

A. Materials and methods required for removing, patching, connections, etc., shall be as specified in the associated specification sections.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL DEMOLITION

A. Comply with NECA 1.

3.2 EXAMINATION AND COORDINATION

A. Examine substrates, areas and conditions with Installer present for compliance with requirements for conditions affecting demolition.

B. Coordinate the demolition scope of work with the Owner and other Contractors to confirm that all required electrical demolition is addressed and scheduled to avoid disputes.

3.3 SELECTIVE DEMOLITION

A. The Electrical Contractor shall remove, cap and/or relocate equipment, outlets, conduit, wire, etc., as shown and specified on drawings and as may become necessary because of existing field conditions. It shall be the responsibility of the Electrical Contractor to visibly examine all existing walls designated for removal to determine the conduit and the wiring that will require capping and/or removal, whether or not such conditions are indicated on the drawings. The contractor shall be held to having visited the site and taken all existing conditions into consideration.

B. Where the architectural drawings indicate that partitions, walls, ceilings, etc., are to be removed the Electrical Contractor shall be responsible for removal of all electrical components within those structures including equipment, lighting fixtures, lighting controls, wiring devices, raceways, wiring, electrical systems, etc.

C. In addition to the foregoing, comply with the following:

1. Maintain circuit continuity to all existing fixtures, equipment, outlets, etc., to remain in use whether noted on the plans or not. Field-verify existing items to remain in use. Wiring for existing circuits which must be re-routed or which are partially abandoned, shall be reconnected to service the remaining outlets on the circuit.
2. In the demolition work, remove all unused wiring and cables and unused conduit that is exposed or within accessible ceilings which is affected by and is in the area of the work of this contract.

D. The intention of the electrical demolition drawings is to disconnect and remove all electrical work made void by the scope of the construction and alteration. Field-verify exact material quantities required to be removed.

E. Abandoned electrical power distribution equipment, including switchboards, motor controllers, panelboards, lighting fixtures and controls and wiring devices shall be disconnected and removed unless otherwise noted. All supporting equipment for this equipment to be removed, including hangers, supporting rods, ballasts, etc., shall be removed.

F. All existing electrical work and associated raceway and wiring, which has been made obsolete by the work and/or is shown dashed on the electrical demolition drawings shall be disconnected and removed back to the source of power unless otherwise noted. Although an attempt has been made to indicate all of this work, total accuracy is not guaranteed. Contractor shall visibly examine all areas and walls and ceilings scheduled for removal to determine existing electrical items to remain.

G. Where electrical equipment, conduit, boxes and supporting hardware are removed, patch and finish the surface as required to match the existing unless otherwise noted.

H. Where buried conduits extending out of a concrete slab become abandoned, cut and grind the conduits off flush with top of slab and plug with non-shrink waterproof grout fill.

I. All removed materials, other than removed materials to be relocated, or stored or turned over to the Owner shall become the property of the Contractor and shall be removed from the project site.

J. Acceptance of contract means installer accepts existing conditions.

K. Contractor shall coordinate all demolition work with all other trades.

L. In walls or floors where a flush device is being removed, but the wall or floor remains or for any outlet which must remain, but has a device removed, provide a blank cover over the outlet. Match the color and material of existing remaining covers in the room or space.

M. In areas where the partitions, ceilings, etc., are indicated to be temporarily removed, the Electrical Contractor shall be responsible for the disconnection, storage, re-installation and re-connection of equipment or devices within that partition, ceiling, etc., unless otherwise noted.

N. Legally dispose of hazardous materials and ballasts or other equipment containing PCBs and lamps containing mercury or equipment containing oil. Comply with all Federal, state, and local laws. This includes HID and fluorescent lamps determined to be hazardous waste. These shall be disposed of at a permitted hazardous waste disposal facility or other appropriately permitted entity.

O. Provide manifests and travel and disposal forms and documents to Owner when required by Owner or regulatory agencies.

3.4 CLEANING

A. Clean existing electrical distribution equipment affected by the project, including switchboards, motor controllers, panelboards, etc. Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide coverplates for openings. Modify existing panelboard directories (or replace) for panelboards which have had alterations to the circuits originating therein. Describe the load and location.

B. Where luminaires are indicated to be retained and re-used, the Electrical Contractor shall clean all exterior and interior surfaces. Lamps and ballasts shall be replaced with new. Broken electrical parts, including guards and lens shall be replaced to match existing construction unless otherwise noted.

3.5 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical demolition to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Occupancy sensors.

B. Related Requirements:

1. Section 26 2726 "Wiring Devices" for wall-box dimmers, and manual light switches.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

C. For products used in lieu of basis of design, submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.

D. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Products supplied shall be from a single manufacturer that has been continuously involved in manufacturing of lighting controls for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

B. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.

C. All occupancy sensors shall be tested to NEMA WD 7-2011 Occupancy Motion Sensors Standard.

1.5 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including luminaires, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide as listed per each sensor type or comparable product by one of the following:

1. Cooper Industries, Inc.
2. Hubbell Building Automation, Inc.
3. Acuity Brands Lighting, Inc.
4. Lutron Electronics Co., Inc.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. Mounting:
    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide as listed per sensor type or comparable product by one of the following:

1. Cooper Industries, Inc.
2. Hubbell Building Automation, Inc.
3. Acuity Brands Lighting, Inc.
4. Lutron Electronics Co., Inc.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 degrees F (0 to 49 degrees C).
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor Tag SO:

1. Standard Range: 180-degree field of view, with a minimum coverage area of 10 feet x 15 feet.
2. Sensing Technology: Dual-technology.
3. Switch Type: field selectable automatic "on," or manual "on," automatic "off."
4. Voltage: Dual voltage, 120 and 277 V
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector between 1 and 30 minutes.

2.3 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions. Ultrasonic sensors to remain minimum of 6 feet from supply air.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 26 0553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Verify occupancy sensors operate per design intent.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Lighting and appliance branch-circuit panelboards.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings and finishes.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by a qualified testing agency and marked for intended location and application.

D. Comply with NEMA PB 1 “Panelboards.”

E. Comply with NFPA 70 “National Electrical Code.”

1.5 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.6 WARRANTY

A. Warranty: Panelboard and components shall be warranted to be free from manufacturing defects for a period of one year after project acceptance by Owner.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Overcurrent Protection Devices: Multiple pole overcurrent protection devices shall be provided with a common trip handle for all poles. Tandem circuit breakers are not allowed.

B. Panelboard Short-Circuit Current Rating: All distribution and branch circuit panelboards shall be fully rated to interrupt symmetrical short circuit current available at terminals. Series rated equipment is not allowed.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Match existing manufacturers.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Circuit Breakers: Provide molded-case, thermal-magnetic, trip-free, bolt-on circuit breakers (unless otherwise noted) replaceable without disturbing adjacent units. Circuit breaker escutcheon shall have ON and OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the "ON" or "OFF" position. Circuit breaker faceplate and handle shall indicate rated ampacity. Circuit breaker faceplate shall indicate UL certification standards with applicable voltage systems and corresponding AIC ratings. Circuit breakers 30 amperes and less shall be UL listed to accept copper conductors with insulation rated at 60, 75 and 90 degrees Celsius, with conductors sized from the 60 degree Celsius column of Table 310.15(B)(16) of the NEC. Circuit breakers larger than 30 amperes shall be UL listed to accept copper conductors with insulation rated at 75 or 90 degrees Celsius with conductors sized from the 75 degree Celsius column of Table 310.16 of the NEC.
2. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits; Type HACR for feeding heating, air conditioning or refrigeration loads. Provide UL Class A ground fault interrupter circuit breakers where scheduled on drawings. Arc fault circuit breakers shall comply with UL 1699; 120/240-V, single-pole configuration.

C. Short Circuit Rating: Provide short circuit rating for each panelboard as indicated on drawings. Ratings indicated are minimum values. Manufacturer shall provide the next larger rating if the value indicated is unavailable.

2.3 OVERCURRENT PROTECTIVE DEVICE ACCESSORY OPTIONS

A. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

B. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.

C. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in the “ON” or “OFF” position.

D. Handle Clamp: Loose attachment for holding circuit-breaker handle in on position.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

B. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit breaker trip ranges as dictated on drawings.

B. Install filler plates in unused spaces.

3.3 IDENTIFICATION

A. Comply with requirements within Division 26 Section "Identification for Electrical Systems."

B. Circuit Directory: Provide typed circuit directory reflective of final circuit changes. Identify all circuits including spares. Spaces shall be left blank. Circuit designations shall describe the load type and location. For example, “Lighting - North Corridor” or “Receptacles - Rooms A, B, C and X, Y, Z.” Use Owner's room designations, not designations shown on the plans, if different. Type on cardboard stock installed behind clear acrylic holder enabling removal of the directory.

3.4 FIELD QUALITY CONTROL

A. Visual and Mechanical Inspection: Include the following inspections and related work:

1. Inspect for defects and physical damage, labeling and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.
2. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.

3. Check panelboard mounting, area clearances, alignment and fit of components.
4. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI and associated device plates.
2. USB charger devices.
3. Cord and plug sets.
4. Floor service outlets, poke-through assemblies, service poles and multi-outlet assemblies.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not allow relief from full compliance with the contract documents.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Comply with NFPA 70.

C. Comply with UL 498: “Attachment Plugs and Receptacles.”

D. Comply with UL 943: “Ground-Fault Circuit-Interrupters.”

E. Listing and Labeling: Provide products which are listed and labeled by Underwriters Laboratories for their applications and installation conditions and for the environments in which installed.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

A. Comply with NEMA Standard WD 1, "General Purpose Wiring Devices" and NEMA Standard WD6 “Wiring Device Dimensional Requirements.”

B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.

C. Receptacles, Straight-Blade and Locking Type: Except as otherwise indicated, comply with UL Standard 498, "Electrical Attachment Plugs and Receptacles." Provide UL labeling of devices to verify these compliances. Provide straight blade receptacles per table on the following page.

D. Any receptacles that are controlled by an automatic control device shall have the centralized receptacle marking furnished with the device or cover plate.

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

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

a. Cooper: 5352.
b. Hubbell: 5352.
c. Leviton: 5352.
d. Pass & Seymour: 5362.

2.3 SNAP SWITCHES

A. Snap Switches: Quiet-type a.c. switches, Underwriters Laboratories listed and labeled as complying with UL Standard 20 "General Use Snap Switches.” Switches shall be heavy duty industrial rated, 20A, 120/277V, ivory handle, back and side wired, number of poles as required, with ground screw.

B. Comply with NEMA WD 1 and UL 20.

C. Switches, 120/277 V, 20 A:

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

a. Cooper: AH1221 (single pole), AH1222 (two pole), AH1223 (three way), AH1224 (four way).
b. Hubbell: HBL1221 (single pole), HBL1222 (two pole), HBL1223 (three way), HBL1224 (four way).
c. Leviton: 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour: 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

D. Combination Switch and Receptacle: Both devices in a single gang unit with plastic ears and removable tab connector that permits separate or common feed connection.

1. Switch: 20 ampere, 120-277 V a.c.
2. Receptacle: NEMA configuration 5-20R.

E. Snap Switches in Hazardous (Classified) Locations: Comply with UL Standard 894, "Switches for Use in Hazardous (Classified) Locations."

2.4 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Satin-finished stainless steel.

B. Device Enclosures for Outdoor and Other Wet and Damp Locations: Enclosure shall be suitable for wet locations while in use in accordance with Article 406.8 (B) and listed and labeled for the specific use by Underwriters Laboratories. Enclosure shall be clearly and visibly marked by the factory with the wording "Suitable For Wet Locations While In Use." Enclosure shall be non-metallic with hinged clear cover and integral key operated cover lock. Cover to have two exit holes for up to 3/8 inch diameter cords with holes located at bottom of cover. Provide cover with device opening matched to type of wiring device used, e.g., duplex receptacle, GFCI receptacle, and toggle switch.

C. Color: Match wiring device except as otherwise indicated.

2.5 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1 including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint and other material that may contaminate the raceway system, conductors and cables.
3. Install device boxes in brick or block walls so that the coverplate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete. Protect devices and assemblies during painting if installed prior to wall painting.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
10. Install devices and assemblies plumb and secure.
11. Install wall plates when painting is complete.
12. Utilize weather-resistant receptacles in wet or damp locations and outdoors.
13. For all devices mounted flush in walls where communications backboards are installed, provide extension ring with sufficient depth for the outlet and coverplate to mount flush to the face of the communications backboard. Devices and coverplates that mount recessed to the communications backboard are not acceptable.
14. Provide GFCI receptacles when installed within 6 ft. of the outside edge of a sink.
15. Provide hospital grade receptacles within all patient care spaces.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943 and per manufacturer’s recommendations.
5. Test wiring devices for proper polarity and ground continuity. Operate each operable device at least 6 times.
6. Using the test plug, verify that the device and its outlet box are securely mounted.
7. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones and retest as specified above.

8. Replace damaged or defective components.

3.4 CLEANING

A. General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 262726

SECTION 265100 - LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior luminaires and accessories.
2. Exit signs.
3. Luminaire supports.

B. Related Sections:

1. Section 26 0923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, digitally addressable lighting control systems, and multi-pole lighting relays and contactors.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. LED: Light Emitting Diode

D. LER: Luminaire efficacy rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. Pole: Luminaire support structure, including tower used for large area illumination.

1.3 SUBMITTALS

A. For each type of luminaire, arranged in order of luminaire designation. Include complete product model number and product data sheets on features, accessories, finishes, and the following:

1. Physical description of luminaire including dimensions, as well as effective projected area for exterior luminaires.
2. Details of attaching luminaires and accessories.
3. Emergency lighting units including battery and charger.
4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
5. LED photometric report per latest IESNA LM-79-08 testing guidelines, including luminaire model number, manufacturer of LED chip array/board and driver, input wattage, and independent testing laboratory name, report number, and date tested.
6. Dimmer device data for all LED luminaires specified as dimming. Must be from approved manufacturer per luminaire manufacturer requirements, furnished and installed by contractor. Contractor responsible for dimmer control and luminaire compatibility.

7. Pole information including: Materials, dimensions, finishes, means of attaching luminaire to support, anchor bolts and templates, structural analysis and manufactured pole foundations.

B. Custom Luminaires: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. LED Chip Arrays/Boards: 3 for every 100 of each type and rating installed. Furnish at least one of each type.
2. LED Drivers: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Diffusers, Lenses, Globes and Guards: 2 for every 100 of each type and rating installed. Furnish at least one of each type.
4. Glass and Plastic Lenses: 2 for every 100 of each type and rating installed. Furnish at least one of each type.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, or by an independent agency complying with the IESNA Lighting Measurements Testing & Calculation Guides.

B. Comply with IEEE C2, “National Electrical Safety Code” and NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver luminaire and components to site. Store such that luminaires, finishes, lenses, and trims are protected. Install with protective films on and remove only after construction clean-up is complete.

B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation. Prevent breakage and damage to finish.

1.8 WARRANTY

A. Warranty Period for LED chips/arrays and drivers: 5 years from date of substantial completion.

B. Warranty Period for Emergency Lighting Unit Batteries, and self-powered exit signs: 5 years from date of substation completion.

C. Warranty Period for Luminaires: 5 years from date of substantial completion.

D. Warranty Period for Poles: 3 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Refer to Luminaire Schedule on the drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES AND COMPONENTS

A. All luminaires shall carry a UL listing, unless otherwise noted on the Luminaire Schedule. Exterior luminaires shall carry a UL wet location listing as well as designated IP rating, unless otherwise noted on the Luminaire Schedule.

B. Recessed Luminaires: Housing shall be constructed of steel or aluminum, free of burrs and sharp corners and edges, free of light leakage and accessible without use of tools. Components shall be formed and supported to prevent warping and sagging. Lamp and ballast compartments shall be accessible from below the ceiling.

1. Lensed troffers shall be provided with hinged door frames and positive spring-loaded latches, UV stabilized acrylic prismatic lenses with a minimum of 0.12 inch thickness, unless otherwise noted on the Luminaire Schedule.
2. Parabolic louvers shall be interlocking low-iridescent, specular anodized aluminum in construction. Number of cells shall be specified on Luminaire Schedule.
3. Direct/Indirect luminaire lamp chambers shall be made of one-piece perforated steel. Reflectors shall have a minimum reflectance of 90 percent.
4. Volumetric luminaires shall have UV stabilized acrylic lens with optical pattern as designated on Luminaire Schedule. Reflectors shall have a minimum reflectance of 90 percent.
5. Where fire-rated ceilings are specified, luminaires should be provided with listed enclosures meeting requirements to maintain fire-rated system rating.

C. Suspended Luminaires: Canopies, power feeds, and mounting accessories shall be coordinated with architectural-designated ceiling type. Luminaires shall be installed plumb and level at luminaire height designated on Luminaire Schedule.

2.3 LIGHT EMITTING DIODE (LED) LUMINAIRE SYSTEMS

A. Light emitting diodes shall have a minimum color rendering index (CRI) of 80 for interior applications and 70 for exterior applications. Refer to Luminaire Schedule for color temperature of the luminaires.

B. Color changing LED chip arrays shall have chip colors as noted on the Luminaire Schedule.

C. LED chips shall be wired so that operation of chip array is not prohibited by failure of one chip.

D. LED Driver:

1. Solid state driver with integral heat sink. Driver shall have overheat, short-circuit and overload protection, power factor 0.90 or above and maximum total harmonic distortion of 20 percent. Surge suppression device for all exterior luminaires.
2. Drivers shall have dimming capabilities as outlined in the luminaire schedule for each luminaire type.
3. Driver shall have a minimum of 50,000 hours rated life.

2.4 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.5 LUMINAIRE SUPPORT COMPONENTS

A. Comply with Section 26 0529 "Hangers and Supports" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single luminaire. Finish same as luminaire.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to luminaire and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Luminaires:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Lay-in Ceiling Luminaire Supports: Use grid as a support element.

1. Install ceiling support system rods or wires for each luminaire. Locate not more than 6 inches (150 mm) from luminaire corners.
2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
3. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on luminaire. Wire or rod shall have breaking strength of the weight of luminaire at a safety factor of 3.

D. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

E. When installing luminaires, the contractor shall use the luminaire manufacturer’s mounting hardware and follow all manufacturer’s installation direction.

F. All recessed downlights must be installed so that the bottom of the throat is even with the finished ceiling plane. The overlapping flange must then fit flush to the ceiling plane/throat. No light leak must be visible. All miscellaneous hardware above the ceiling plane to accomplish the above shall be included in the base bid.

G. All recessed downlights shall have self-flanged reflectors unless otherwise noted.

H. When luminaires are installed in continuous rows of 2 or more, luminaires shall be approved for use as wireway.

I. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

C. Illumination Observations: Verify normal operation of luminaires after installing luminaires and energizing circuits with normal power source.

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 ADJUSTING AND CLEANING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

B. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires. Touch up luminaire and pole finishes as necessary.

C. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

END OF SECTION 265100

SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section specifies the basic requirements for electrical installations and includes requirements common to all sections of Division 27. It expands and supplements the requirements specified in sections of Division 01.

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

C. Codes and Standards: All equipment, material and installations shall comply with applicable codes, standards, and installation practices. Comply with the requirements of the applicable local building code, the applicable NEC, all local rules and regulations including those of the fire authorities. Comply with all applicable NFPA standards. All material and equipment shall be listed by the Underwriters Laboratories (UL) standard that is applicable for the specific purpose of the material and equipment. The National Electrical Code, National Electrical Manufacturer's Association (NEMA) Standards, and applicable ANSI and IEEE standards shall apply to the pertinent materials, equipment, and installation practices. Testing shall be in accordance with the applicable International Electrical Testing Association (NETA) standards.

1.2 SUMMARY OF WORK

A. The Contractor shall furnish and install all new materials as indicated on the drawings and specifications and all items required to make the communications system complete and in working order.

B. System descriptions included in scope of work are as follows:

1. Low voltage communications systems, including outlet/connectors, cabling, patch panels, terminations, etc
2. Selective demolition work and/or modification of existing systems and equipment.
3. Low voltage systems rough-in, as indicated on drawings, for installation of low voltage equipment by others.

C. Work not included:

1. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) shall be by other Contractors.

1.3 WORK SEQUENCE

A. All work that produces excessive noise and/or interference with normal building operations, as indicated on the drawings, shall be coordinated and scheduled with the Owner. Such work may require scheduling of work after occupied hours or weekends. The Owner reserves the right to determine when such work is conducted.

1.4 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, CONTROLS AND LOW VOLTAGE CONTRACTORS

A. Division of work is the responsibility of the Prime Contractor.

1.5 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor shall thoroughly review the contract documents and specifications and visit the site prior to issuing bid. Resolve all reported deficiencies with the Architect or Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect or Engineer will be done at the Contractor's risk.

B. Qualifications:

1. Telecommunications Qualifications:

a. Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

2. Telecommunications Contractor:

a. The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

3. Key Personnel:

a. Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.
b. Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel.
c. In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the

provided products. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications systems and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

4. Minimum Manufacturer Qualifications:

   a. Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with EIA TIA/EIA-568-C.

C. If there is any discrepancy between a manufacturer's recommendation and these specifications, inform the Architect or Engineer in writing requesting a clarification.

D. Examination of Drawings:

1. The drawings for the indicated work are diagrammatic, intended to convey the scope of the communications work and to indicate the general arrangements and locations of equipment, outlets/connectors, etc., and the approximate sizes of equipment. Field verification of dimensions on plans is required. The actual conditions, including heights, lengths and orientation shall be the basis of the work.
2. The architectural, structural, mechanical, electrical, and communications drawings and specifications shall be considered as mutually explanatory and complementary. Any communications work called for by one and not by the other shall be performed as though required by all. All sections and subsections of the Communications work shall be governed by and subject to the general and supplementary conditions. Any discrepancies in or between the drawings and specifications, or between the drawings and actual field conditions shall be reported to the Architect or Engineer in sufficient time to issue an addendum for clarification.
3. Contractor shall determine the exact locations for equipment and rough-ins, and the exact routing of pathways.
4. Drawings shall not be scaled to determine equipment and system locations.
5. Not all required components are shown on the documents, including junction boxes, pull boxes, conduit fittings, etc. Contractor shall provide all components required for proper installation of the work.
6. Any item either shown on the drawings or called for in the specifications shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better quality number shall govern.
8. Where used in communications documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.

10. Any item listed as installed shall be furnished unless otherwise noted.

E. Electronic Media and Files:

1. Construction drawings for this project have been prepared using AutoCAD Release 2017.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contactor shall complete and return a signed “Electronic File Transmittal” form provided by Ross & Baruzzini.
4. If the information requested includes floor plans prepared by others, the Contractor shall be responsible for obtaining approval from the appropriate Design Professional for use of the part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and record drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by Ross & Baruzzini for bidding purposes may not be used directly for raceway layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by Ross & Baruzzini as to the accuracy or correctness of the information provided. Ross & Baruzzini accepts no responsibility or liability for the Contractor’s use of these documents.

1.6 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Coordinate equipment rough-in requirements with Divisions 02 through 28.

1.7 CONTRACTOR’S SUBMITTAL REVIEW RESPONSIBILITIES

A. General: Submittals are not requested for all products covered in the specifications. Submit only the data requested under the submittals portion of each specification section or where indicated in a Submittal Log, if included within Division 01. Un-requested submittals will not be processed, reviewed or returned and the contractor will be notified that the submittal will not be reviewed by the engineer of record.

1. Non-requirement of submittals, when so noted, is not to be construed as an allowance for substitutions and does not relieve the contractor from full compliance with the plans and specifications.
2. Any deviation from specified items is considered a substitution. If the contractor desires to use other than specified items, then a formal request for substitution must be submitted prior to bid date (no exceptions), in accordance with the procedures and time limitations set forth in Division 01. Where not defined in Division 01, requests for substitutions shall be submitted no less than ten (10) working days prior to bid date. Review of substitution requests by the Engineer shall be done at the expense of the contractor. Charges for this substitution review shall be calculated based on the Engineer’s standard hourly rates, as defined in their contract with the Owner.

B. It is the responsibility of the Contractor to ensure that all submittals have been reviewed for total completeness and accuracy as to the requirements of the specifications and drawings before being submitted to the Engineer for review.

1. One comprehensive submittal shall be provided for each individual specification section. All required submittal information called for in each individual specification section shall be included in the submittal.
2. The Engineer of Record shall not be responsible for informing the contractor on items that have not been included and are necessary for a complete review of the required submittal information for a specification section.
3. The Engineer of Record shall have the option of returning any submittal, unmarked, if all required documentation called for in the specifications has not been provided in the submittal.
4. The Engineer of Record shall review each submittal no more than two (2) times and return to the contractor with the appropriate disposition.
5. If the Engineer of Record is required to review a submittal a second time, it shall be limited to review of the changed information, clearly highlighted by the submitter, and/or confirmation of documentation only and it shall be returned to the contractor with the appropriate disposition.
6. If the submittal is required to be reviewed a third time, it shall be done at the expense of the contractor. Charges for this additional submittal review shall be calculated based on the Engineer's standard hourly rates, as defined in their contract with the Owner.

C. Operation and Maintenance Manuals: All items required for insertion into each Operation and Maintenance (O&M) Manual are called out in the submittals portion of each specification section or in a Submittal Log, if included within Division 01. It is the responsibility of the Contractor to ensure that the O&M submittal has been reviewed and includes all the requirements of the specifications. The Engineer of Record shall review the submittal for the Operation and Maintenance Manual one (1) time and return to the contractor with the appropriate disposition.

1. If the submittal is required to be reviewed a second time, it shall be done at the expense of the contractor. Charges for this additional submittal review shall be calculated based on the Engineer's standard hourly rates, as defined in their contract with the Owner.
2. Submittals for the Operation and Maintenance Manual must be original documentation.
3. Photo copies of marked up Operations and Maintenance submittals are not acceptable.

D. Coordination Drawings: Prepare and submit Coordination Drawings as further described herein and as indicated in the Special Conditions. The Engineer shall receive one copy of all coordination drawings supplied to the Owner as required in this specification. It is the responsibility of the Contractor to coordinate the work as outlined herein. Receipt by the Engineer of a copy of the coordination drawings is to verify conformance to the submittal requirements set forth in this specification section. It is not an admission by the Engineer as to the accuracy or completeness of the coordination proposed.

E. Refer to Division 01 and each individual Division 23 Section for additional submittal requirements.

1.8 ELECTRICAL SUBMITTALS

A. General: Submittals are not requested for all products covered in the specifications. Submit only the data requested under the submittals portion of each specification section. Un-requested submittals will not be processed or reviewed. FAX or photo copies are not allowed as submittals for operating and maintenance manuals. Submittals for operating and maintenance manuals must be on original manufacturer printed stock. Non-requirement of submittals, when so noted, is not to be construed as an allowance for substitutions and does not relieve the Contractor from

full compliance with the plans and specifications. Any deviation from specified items is considered a substitution. If the Contractor desires to use other than specified items, then a formal request for substitution must be submitted prior to bid date, in accordance with the methods and times indicated in these specifications.

B. Definitions:

1. Product Data: Pre-printed manufacturer's data.
2. Shop Drawings: Drawings made specifically for the manufacture of a particular piece of equipment to be used on this project.
3. Operation and Maintenance Data: Information containing instructions on the proper operation, maintenance and repair of the equipment, complete with written text, diagrams, photos, exploded views and parts lists.
4. Record Documents: Information indicating the actual installed conditions of the project on Mylar, electronic media, photographs or typed paper. Submit type, quantities and on media specified where indicated to be submitted.

C. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. Contractor’s approval stamp is required on all submittals. Approval will indicate the Contractor’s review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If the Contractor does not mark deviations, then the item shall be required to meet all drawing and specification requirements.

D. Where more than one model is shown on a manufacturer’s sheet, clearly indicate exactly which item and which data is relevant to the work.

E. Where the manufacturer lists multiple part numbers or options on a single data sheet, the part number and options to be used shall be clearly set apart from other part numbers shown on that sheet.

1.9 PRODUCT OPTIONS AND MATERIAL SUBSTITUTIONS

A. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, and similar items used in Work except as otherwise indicated.

B. Provide products which are compatible within systems and other connected items.

C. Substitutions: Products other than those specified must be submitted, approved and secured in writing from the Architect/Engineer via Addendum. If requested, a sample of the proposed substitution may be submitted to the Architect/Engineer for evaluation. This sample shall be supplied at no cost to the Architect/Engineer, and will be returned to the Contractor, at the Contractor's expense at the end of the evaluation period.

D. Where several manufacturers’ names are given, the manufacturer for which a catalog number is given is the basis of design and establishes the quality required.

E. Any material, article or equipment of other unnamed manufactures which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect or Engineer via Addendum. The Contractor

assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.

F. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on his part or on the part of other Contractors whose work is affected.

G. All material substitutions requested after the final Addendum must be listed as voluntary changes on the bid form.

1.10 PRODUCT, DELIVERY, STORAGE, HANDLING AND MAINTENANCE

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage and handling. Protect stored equipment and materials from damage. Coordinate delivery and storage of materials with environmental conditions. Delivery and storage shall not occur until adequate environmental conditions are maintained.

B. Coordinate deliveries of communications materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations. If not noted on the drawing, it is the Contractor’s responsibility to review the site prior to bid for path locations and any required building modifications to allow movement of equipment.

C. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.

D. Keep all materials clean, dry and free from damaging environments.

1.11 MISCELLANEOUS MATERIALS

A. Miscellaneous Materials Include:

1. Miscellaneous metals for support of communications materials and equipment.
2. Wood grounds, nailers, blocking, fasteners and anchorage for support of communications materials and equipment.
3. Sealers for sealing around communications materials and equipment; and for sealing penetrations in floors and walls.
4. Access panels and doors in walls, ceilings, and floors for access to communications materials and equipment.

1.12 WARRANTIES

A. Refer to the Division 01 “Closeout Procedures” for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division(s) 27 into a separated set of vinyl covered, three-ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, telephone numbers and procedures for filing a claim and obtaining warranty services.

D. Warranty requires correction of all work found to be defective or nonconforming to the Contract Documents, without cost to the Owner. The Contractor shall bear all costs associated with corrective measures and damage due to defects or nonconformance with the Contract Documents, excluding repairs required as a result of improper maintenance or operation, or normal wear and tear as determined by the Architect/Engineer.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS LUMBER

A. All lumber shall be fire-treated.

B. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative-treated in accordance with AWPB LP-2, and kiln-dried to a moisture content of not more than 19 percent.

2.2 ACCESS DOORS

A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

B. Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile or wood paneling.

C. For Installation in Masonry, Concrete, Ceramic Tile, or Wood Paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.

D. For Gypsum Wallboard or Plaster: Perforated flanges with wallboard bead.

E. For Full-Bed Plaster Applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

F. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.

G. Fire-Rated Units: Insulated flush panel doors with continuous piano hinge and self-closing mechanism.

H. Locking Devices: Flush, screwdriver-operated cam locks.

I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bar-Co., Inc.
2. J.L. Industries.
3. Karp Associates, Inc.

4. Milcor Div. Inryco, Inc.
5. Nystrom, Inc.

2.3 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time and recommended for interior and exterior applications.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounted items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right-of-Way: Give to piping systems installed at a required slope.

F. Jobsite Safety: The Contractor is the sole entity responsible for jobsite safety.

3.2 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of sealants and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Install equipment and materials in accordance with manufacturer instructions and the requirements in Section 20 0800 "Seismic Protection."

3.3 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Coordinate equipment rough-in requirements with Divisions 02 through 28.

3.4 COMMUNICATIONS INSTALLATIONS

A. Coordinate communications equipment and materials installation with other building components.

B. Verify all dimensions by field measurements.

C. Arrange for chases, slots, and openings in other building components to allow for communications installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.

E. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

F. Coordinate connection of communications systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

G. Install systems, materials and equipment to conform to project requirements and approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.

H. Systems, materials and equipment which will be exposed in finished areas shall be installed level and plumb, parallel and perpendicular to other building systems and components.

I. Install communications services and overhead equipment to provide the maximum headroom possible where mounting heights are not detailed or dimensioned.

J. Install communications equipment to facilitate maintenance and repair or replacement of equipment components. Maintain code clearances in front of and about all electrical equipment.

As much as practical, connect equipment for ease of disconnecting with minimum of interference with other installations.

K. Coordinate the installation of communications materials and equipment above ceilings with suspension system, mechanical equipment and systems and structural components.

L. Include in the Work all labor, materials, equipment, services, apparatus and drawings (in addition to the Contract Documents) as required to complete the intended Work.

M. Only new, clean and perfect equipment, apparatus, materials and supplies of latest design and manufacture shall be incorporated in the Work in order to assure a communications system of high quality.

N. The Work required to be done by the Contractor, the Access Provider companies and the Owner, in order to obtain utility services such as telephone, is delineated in these specifications and on the drawings. Unless otherwise noted, construction or connection charges (except for temporary power) by those companies shall be paid by the Owner.

3.5 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 01 Section "Execution." In addition to the requirements specified in Division 01, the following requirements apply:

1. Perform cutting, fitting and patching and materials required to:

   a. Uncover Work to provide for installation of ill-timed Work.
   b. Remove and replace defective Work.
   c. Remove and replace Work not conforming to requirements of the Contract Documents.
   d. Remove samples of installed Work as specified for testing.
   e. Install equipment and materials in existing structures.
   f. Cut, remove, and legally dispose of selected communications equipment, components, and materials as indicated, including but not limited to, removal of communications items indicated to be removed and items made obsolete by the new Work.

2. Coordinate the cutting and patching of building components to accommodate the installation of communications equipment and materials.

   a. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.
   b. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit and place wood grounds, nailers, blocking and anchorage accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 APPLICATION OF SEALERS

A. General: Comply with sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

1. Comply with recommendations of ASTM C 962 for use of elastomeric sealants.

B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.9 INSTALLATION OF ACCESS DOORS

A. Set frames accurately in position and securely attached to supports with face panels plumb and level in relation to adjacent finish surfaces.

B. Adjust hardware and panels after installation for proper operation.

3.10 SLEEVE-SEAL INSTALLATION

A. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve.

B. Install to seal exterior wall penetrations.

C. Provide in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. Provide insulated bushings at each end of sleeve. For sleeves through fire rated-wall or floor construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables.

1. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

3.11 FIRESTOPPING

A. Apply rated firestopping sealants at all penetrations of fire and smoke walls; at all penetrations of floors and at other locations as noted on the drawings or where required by Code. Consider walls that are common to different abutting buildings, to different additions to buildings, and to fire and smoke separations within buildings as requiring firestopping sealant. Refer to architectural drawings. For existing buildings where fire separations are not noted on any drawings, use reasonable logic as to which separations are fire-rated. When in doubt, consult with Engineer or Architect.

B. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.12 PAINTING

A. Paint all equipment that is marred or damaged prior to the Owner’s acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.

B. Equipment in finished areas that will be painted to match the room finish will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room finish. Painting shall be performed as described in the project specifications.

C. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.

D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with based enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Architect or Engineer his color preference prior to ordering.

E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, and storage rooms. Equipment furnished with a suitable factory finish need not be painted; provided the factory-applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as the factory applied.

F. Do NOT paint electric conduits in crawl spaces, tunnels, or spaces above suspended ceilings. Except where conduit is in a damp location give exposed threads at joints two coats of sealer after joint is made up.

G. After surfaces have been thoroughly cleaned and are free of oil, dirt or other foreign matter, paint all raceway and equipment with the following:

1. Bare Metal Surfaces: Apply one coat of metal primer suitable for the metal being painted. Finish with two coats of alkyd base enamel paint.
2. Plastic Surfaces: Paint plastic surfaces with two coats of semi-gloss acrylic latex paint.

3.13 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner’s final acceptance of the project.

B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc., from all equipment.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

D. Refer to the Division 01 Section "Closeout Procedures" for general requirements for final cleaning.

3.14 SPECIAL REQUIREMENTS

A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.

B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement and orientation of equipment with the Owner's representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.

3.15 OPERATION AND MAINTENANCE DATA

A. Refer to the Division 01 Section: "Closeout Procedures" for procedures and requirements for preparation and submittal of maintenance manuals.

B. In addition to the information required by Division 01 for Maintenance Data, include the following information:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions, regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventive maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

C. Submit three (3) properly indexed and bound copies in "D" ring style notebooks, of the Operations and Maintenance Instructions to the Architect or Engineer. Make all corrections or additions required.

D. Operation and Maintenance Instructions shall include:

1. Notebooks shall be heavy duty locking three-ring binders, black in color, and incorporate clear vinyl sheet sleeves on the front cover and spine for slip-in labeling. "Peel and stick" labels are **not** acceptable. Sheet lifters shall be supplied at the front of each notebook. Size notebooks a minimum of 1/2 inch thicker than the material for future inserts. Label the spine and front cover of each notebook. If more than one notebook is required, label in consecutive order. For example; 1 of 2, 2 of 2. No other forms of binding will be acceptable.

2. Prepare binder covers (front and spine) with printed title “Operation and Maintenance Instructions,” title of project, and subject matter of binder when multiple binders are required.
3. Title page with project title, Architect, Engineer, Contractor, and Subcontractor with addresses, telephone numbers, and contacts.
4. Table of Contents describing all index tabs.
5. Listing of all Subcontractors and major equipment suppliers with addresses, telephone numbers and contacts.
6. Index tabs dividing information by specification section, major equipment, or systems. All tab titles shall be clearly printed under reinforced plastic tabs. Label all equipment to match the identification in the construction documents.
7. Copies of warranties.
8. Copies of all final approved shop drawings and submittals. Copy of power system study and overcurrent protective device settings.
9. Copies of all factory inspections and or equipment start-up reports.
10. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
11. Dimensional drawings of equipment.
12. Detailed parts lists, each with a list of suppliers.
13. Operating procedures for each system.
14. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
15. Repair procedures for major components.
16. Replacement parts and service material requirements for each system and the frequency of service required.
17. Instruction books, cards, and manuals furnished with the equipment.

E. Operation and maintenance data shall consist of written instructions for the care, maintenance, and operation of the equipment and systems. Instruction books, cards, manuals furnished with the equipment shall be included.

F. Adequately instruct the Owner’s designated representative in the maintenance, care, and operation of the complete systems installed under this contract.

G. Notify the Architect or Engineer of the time and place for the verbal instructions to the Owner’s representative so his representative can be present if desired.

H. Minimum hours of instruction time for each item and/or system shall be as indicted in each individual specification section.

I. Operating Instructions:

1. The Contractor is responsible for all instructions to the Owner’s representatives for the electrical and specialized systems.
2. If the Contractor does not have staff that can adequately provide the required instructions, he shall include in his bid an adequate amount to reimburse the owner for the Engineer to perform these services.

3.16 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 01 Section "Closeout Procedures." In addition to the requirements specified in Division 01, indicate installed conditions for:

1. Major raceway systems, size and location, for both exterior and interior.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract modifications, and actual equipment and materials installed.
4. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; support and hanger details; change orders; concealed control system devices.
5. Mark Specifications to indicate approved substitutions, change orders, actual equipment and materials used.

B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; backbone and horizontal communication cabling; communications equipment size and arrangements; support and hanger details; Change Orders; concealed control system devices.

D. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, clarifications, and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete record documents as required by this contract, this Contractor shall reimburse the Architect or Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect or Engineer’s hourly rates in effect at the time of the work.

E. Record changes daily and keep the marked drawings available for the Architect or Engineer’s examination at any normal work time.

F. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect or Engineer.

3.17 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 01:

B. Final Jobsite Observation:

1. The Contractor shall certify that the project jobsite is ready for the final jobsite observation.
2. If the project jobsite is not ready for final observation and additional trips are required by the Engineering team for review of final conditions, the Contractor shall reimburse the additional time and expenses to the Engineer by reduction in Contractor's final payment.
3. The Engineer shall be notified a minimum of 48 hours (two typical working days) prior to installation of ceiling tiles or lay-in ceilings to allow the Engineer to visit the project site.

C. Submit the following documents to the Architect or Engineer prior to requesting final payment:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including electronic AutoCAD drawings and specifications.

3. Documentation of completion of all required training of Owner's personnel.
4. Provide spare parts, maintenance and extra materials in quantities specified in individual specification sections.
5. Inspection and testing reports.
6. Start-up reports on all equipment requiring a factory installation or start-up.

END OF SECTION 270500

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SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS 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. Applicable requirements of Division 260500, “Common Work Results for Electrical.”
2. Supplementary to Division 01, Refer to Division 27 Section for additive information where applicable.

1.2 SUMMARY

A. Section Includes:

1. Furnish and install labeling for all communications products, including but not limited to:

a. Patch panels.
b. Device plates.
c. Cabling.

B. Labeling system shall be an ANSI/TIA/EIA-606 compliant system - The Administrative Standard for the Telecommunications Infrastructure of Commercial Building Identification System.

1.3 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled by Underwriters Laboratories for the specific purpose and comply with the following standards:

1. “Telecommunications Distribution Methods Manual” published by the Building Industry Consulting Services International (BISCI).

1.4 SUBMITTALS

A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not relieve the contractor from full compliance with the plans and specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers shall meet all specifications requirements.

2.2 GENERAL REQUIREMENTS

A. Labeling guidelines are TIA/EIA 606-A Administrative Standard for Commercial Telecommunications Infrastructure and all active Addendums with Owner specific asset nomenclature.

B. All label material shall be suitable for intended usage and environment, meeting the legibility, defacement and general exposure requirements listed in UL 969 for indoor and outdoor use. Where insert labels are used the insert label shall be covered with clear cover and securely held in place.

C. Interior labeling: printer shall be of the thermal transfer type capable of printing self laminating labels of various size up to and including 1.5 inches by 1.5 inches printable area with a 4.5 inches self laminating tail. Non-self-laminating labels are unacceptable.

D. All labels shall be permanent, i.e. shall not fade, peel, or deteriorate due to environment or time.

E. Handwritten labels are not acceptable.

2.3 CONDUITS AND PATHWAYS

A. Conduits: General-purpose label designed for powdered coated surfaces with an ultra-aggressive adhesive, trade name, “Mondo Bondo” (Brady) or equivalent. Label size shall be appropriate for the conduit size. Font size shall be easily visible from the finished floor.

B. Junction boxes (larger than four-inch x four-inch): General-purpose label designed for powdered coated surfaces with an ultra-aggressive adhesive, trade name, “Mondo Bondo”, Brady part number PTL-43-483 (1.90 inches X continuous) or equivalent. Font size shall be easily visible from the finished floor.

C. Junction boxes (four-inch x four-inch): General-purpose label designed for powdered coated surfaces with an ultra-aggressive adhesive, trade name, “Mondo Bondo”, Brady part number PTL-42-483 (1.00 inch X continuous) or equivalent.

2.4 BACKBONE AND HORIZONTAL CABLE AND TERMINATIONS

A. Patch panels: Gloss white film with a permanent acrylic based adhesive, Brady part number PTL-39-422 (.375 inch X .60 inch) or equivalent.

B. Modular Faceplate: Highly durable, non-adhesive, polypropylene tag stock used for thermal transfer printing of faceplate designation strip, Brady part number PTI-40-412 (1.938 inches x .375 inch) or equivalent.

C. Horizontal cabling, patch cords, inside copper and low pair count (12 strands or less) fiber optic cable: Permanent acrylic adhesive, self-laminating vinyl wire and cable identification, Brady part number PTL-31-427 (1.00 inch X 1.50 inches) equivalent.

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. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

F. Conduits and Junction/Pull Boxes:

1. All conduits, innerduct, junction boxes, gutters and pull boxes shall be labeled.
2. Conduits shall be labeled with the word “COMMUNICATIONS” and the conduit’s origination room number and destination room number. Permanent room identifiers shall be used.
3. Label conduit every 50 feet, at each wall and floor penetration and at each conduit termination, such as outlet boxes, pull boxes, and junction boxes, or as otherwise specified in other Sections.
4. Junction boxes, gutters and pull boxes shall be labeled with identification name or number as determined by Contractor.
5. Labels on conduits, junction boxes, gutters and pull boxes shall be machine-generated and easily visible from the finished floor.

G. Horizontal Copper Cable

1. Horizontal copper cabling shall be installed on patch panels specified for horizontal copper cable only.
2. Each horizontal copper patch panel is to be labeled as follows:

    a. Patch Panel #.
    b. Location: building, floor, room #.
    c. Areas served by room #.
    d. Corresponding Work Area outlet port numbers.
    e. Date installed.
    f. Date Tested.
    g. Installed by.

3. The Work Area outlet port/jack labeling shall reflect the corresponding patch panel and port number.
4. Work Area outlets vary in ports per outlet configuration. Each outlet shall be labeled with the serving Telecom Room #, Patch Panel # and sequential numbering from lowest port number to highest port number. Each port shall be individually labeled with its unique sequential port number.
5. The following information for each horizontal cable installed shall be provided in table format. Both a hard copy and electronic copy are to be provided. Electronic information is to be in Excel or compatible format.

a. Work Area outlet port #.
b. Type: e.g. category 6 UTP.
c. Location: building, floor, room #.
d. Serving telecom room.
e. Corresponding patch panel and port number.
f. Manufacturer.
g. Date installed.
h. Date Tested.
i. Installed by.

H. The following color coding scheme shall be used:

1. Horizontal Wiring:

a.	Data	Blue
b.	Voice	White

I. Three copies of the cable record document containing the cable information required on the cable labels shall be delivered to the Owner.

3.2 TRAINING

A. Conduct a walk-through of the project site and demonstrate the presence and location of all key labeling elements used.

B. Furnish handouts to all owner personnel attending training that clearly depicts the labeling scheme used on the project.

END OF SECTION 270553

SECTION 270810 - VERIFICATION TESTING OF STRUCTURED CABLING

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. Applicable requirements of Division 260500, “Common Work Results for Electrical.”
2. Supplementary to Division 01, Refer to Division 27 Sections for additive information where applicable.

1.2 SUMMARY

A. Section Includes:

1. The work covered by this Specification Section includes any and all requirements for this type work required for proper commissioning of work specified in each related Division 27 and 28 specification section and as shown on the drawings.
2. Provide all labor, materials, tools, field-test instruments and equipment required for the complete testing of the work called for in the contract documents.

    a. This Section is a “Common Work Results” Section that includes information that is applicable and related to all Division 27 Sections.

1.3 DEFINITIONS

A. Nominal Velocity of Propagation (NVP): Expressed as the ratio of the signal speed in the cable and the speed of lighting in a vacuum.

1.4 SUBMITTALS

A. Closeout Submittal:

1. Copper (Twisted Pair) Test Result Documentation:

    a. The test result information for each link shall be recorded in the memory of the field tester upon completion of the test.
    b. The test result records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that these results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test. The popular ‘csv’ format (comma separated value format) does not provide adequate protection and shall not be acceptable unless specified by the end user.
    c. The database for the completed job, including twisted-pair copper cabling links if applicable, shall be stored and delivered on CD-ROM. This CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.
    d. Circuit IDs reported by the test instrument shall match the specified label ID.

e. A copy of the test results shall be provided that lists all the links that have been tested with the following summary information. The copy may be delivered on paper or electronically as specified by the end user.

1) The identification of the link in accordance with the naming convention defined in the overall system documentation.
2) The overall Pass/Fail evaluation of the link-under-test.
3) The date and time the test results were saved in the memory of the tester.

f. General Information to be provided in the electronic data base containing the test result information for each link:

1) The identification of the customer site as specified by the end-user.
2) The overall Pass/Fail evaluation of the link-under-test.
3) The name of the standard selected to execute the stored test results.
4) The value of the NVP of the cable installed; used for length calculations.
5) The date and time the test results were saved in the memory of the tester.
6) The brand name, model and serial number of the tester.
7) The revision of the tester software and the revision of the test standards database in the tester.

g. The detailed test results data to be provided in the electronic database for each tested link must contain the information as set forth in Part 3.

1.5 QUALITY ASSURANCE

A. The Prime Contractor or his subcontractor responsible for this Section shall have a Registered Communications Distribution Designer (RCDD) on staff that will be ultimately responsible for this Project. The RCDD must have sufficient experience in this type project as to be able to lend adequate technical support to the field forces during installation, the warranty period, and any extended warranty periods or maintenance contracts.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled by Underwriters Laboratories for the specific purpose and comply with the following standards:

1. ANSI/TIA/EIA-568-C.1, Commercial Building Telecommunications Cabling Standard.
2. ANSI/TIA/EIA-568-C.2 – Balanced Twisted Pair Telecommunications Cabling and Components Standard.
3. “Telecommunications Distribution Methods Manual” published by the Building Industry Consulting Services International (BISCI).

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Copper (Twisted Pair) Test Equipment:

1. Category 6 Compliance:

a. The test equipment (tester) shall comply with the accuracy requirements for level III field testers as defined in the TIA Cat 6 Document. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The

accuracy requirements for the permanent link test configuration (baseline accuracy *plus* adapter contribution) are specified the TIA Cat 6 Standard.

b. The test plug shall fall within the values specified in E.3.2.2 Modular test plug NEXT loss requirements of the TIA Cat 6 Standard.

c. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

d. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy, preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

e. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests (detailed in Part 3). Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.

f. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks.

2. Utilize the appropriate test equipment as manufactured by Datacom Technologies, Fluke, MicroTest, Scope, WaveTek, WireScope or equal. Print test results from the test unit used. Documentation shall include meter catalog number, serial number, manufacturer, cable identifier, Equipment Room/Telecommunications Room identifier, cable type, NVP settings, meter readings, test date, calibration information, and operator responsible for tests.

PART 3 - EXECUTION

3.1 GENERAL

A. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.

B. Testing shall be carried out in accordance with this document.

C. Testing shall be performed on each cabling link (connector to connector).

D. Testing shall not include any active devices or passive devices within the link other than cable, connectors, and splices.

E. Every cabling link in the installation shall be tested in accordance with the field test specifications defined in ANSI/TIA/EIA-568B. This document will be referred to as the “TIA Cat 6 Standard.”

F. The installed twisted-pair horizontal links shall be tested from the MDF/IDF (ER/TR) in the telecommunications room to the telecommunication wall outlet in the work area against the "*Permanent Link*" performance limits specification as defined in the TIA Cat 6 Standard.

G. One hundred percent of the installed cabling links must be tested and must pass the requirements of the standards mentioned above and as further detailed in Part 3. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

3.2 COPPER (TWISTED PAIR) TESTING

A. General:

1. Field-test instruments shall have the latest software and firmware installed.
2. Link test results from the Test Equipment shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.
3. Testing shall be performed on each cabling segment (panel to connector or connector to connector).
4. Testing of the cabling shall be performed using high-quality test cords of the same Category and manufacturer as the cabling under test.

B. Performance Test Parameters:

1. The test parameters for Cat 6 are defined in TIA Cat 6 standard, which refers to the ANSI/TIA/EIA-568B standard. Test results shall at a minimum show alien attenuation crosstalk ratio far-end (AACRF), alien far-end crosstalk (AFEXT), alien near-end crosstalk (ANEXT), power sum alien attenuation crosstalk ratio far-end (PSAACRF), power sum alien far-end crosstalk (PSAFEXT), and power sum alien near-end crosstalk (PSANEXT).

3.3 COORDINATION/VERIFICATION

A. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase five business days before testing commences.

B. A representative of the end-user may elect to select a random sample of 5 percent of the installed links. The representative (or his authorized delegate) shall test these randomly selected links and the results are to be stored in accordance with the prescriptions in Section A.3. The results obtained shall be compared to the data provided by the installation contractor. If more than 1 percent of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the end-user representative shall repeat 100 percent testing and the cost shall be borne by the installation contractor.

1. All tests shall be documented including OLTS dual wavelength attenuation measurements for multimode and singlemode links and channels and OTDR traces and event tables for multimode and singlemode links and channels.

3.4 ACCEPTANCE OF TEST RESULTS

A. Unless otherwise specified by the Owner or the Owners representative, each cabling link shall be in compliance with the following test limits:

1. All installed cabling links and channels shall be field-tested and pass the test requirements and analysis. Any link or channel that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected link or channel meets performance requirements. The final and passing result of the tests for all links and channels shall be provided in the test results documentation in accordance with Part 3.
2. Acceptance of the test results shall be given in writing after the project is fully completed and tested in accordance with Contract Documents and to the satisfaction of the Owner.

END OF SECTION 270810

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SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

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. Applicable requirements of Division 260500, “Common Work Results for Electrical.”
2. Supplementary to Division 01, Refer to Division 27 Sections for additive information where applicable.

1.2 SUMMARY

A. Section Includes:

1. Supply and installation of a complete and working Horizontal Cabling Systems for:

a. Voice / Telephone.
b. Data / Network.

1) Including data provisions for other systems (e.g., Video Surveillance, Access Control, Control Data, Intrusion Detection, etc.).

2. System includes but is not limited to:

a. Horizontal cabling.
b. Station outlets including frames, connector modules, and cover plates.
c. Patch panels.

1.3 DEFINITIONS

A. Communications Plenum Cable (CMP): Complies with NFPA-262 and UL-910. Cable allowed in spaces defined as air plenums. CMP cables must self extinguish and not reignite. These cables produce less smoke than standard PVC jacketed cables.

B. Communications Riser Cable (CMR): Complies with UL-1666. Cable for usage in vertical applications such as cable runs between floors. Cables must self extinguish and must also prevent the flame from traveling up the cable in a vertical burn test.

1.4 SUBMITTALS

A. General:

1. Provide product data submission for this specification section as part of one all inclusive Division 27 submittal. The all inclusive Division 27 submittal shall be organized with a single sub-section for each Division 27 specification section.

B. Items to be submitted for approval prior to commencement of work:

1. Product Data:

a. Manufacture datasheets for all cable.
b. Manufacture datasheets for all connectors.

C. Closeout Submittal:

1. Contractor shall provide system warranty documentation at project close out.

1.5 QUALITY ASSURANCE

A. The Prime Contractor or his subcontractor responsible for this Section shall have a Registered Communications Distribution Designer (RCDD) on staff that will be ultimately responsible for this Project. The RCDD must have sufficient experience in this type project as to be able to lend adequate technical support to the field forces during installation, the warranty period, and any extended warranty periods or maintenance contracts.

B. The system shall be an ANSI/TIA/EIA 568-B compliant Unshielded Twisted Pair (UTP) horizontal cabling system.

C. The system shall consist of total connectivity for a complete and permanent installed communications link.

D. All system cables shall be UL/NEC rated for the location, manner and site conditions in which the cables are installed. This includes, but is not limited to:

1. Use of the cable rated for the application.
2. Not exceeding fill capacities of raceways.
3. All cable used shall be in compliance with Local, State, and Federal laws (at minimum the NFPA published “National Electric Code”) as to acceptability for placement in the designed pathway. This includes, but is not limited to, cable fill capacities of raceways and plenum vs. non-plenum construction. The Contractor shall provide and install the appropriate cable for the appropriate conditions.

E. Listing and Labeling: Provide products specified in this Section that are listed and labeled by Underwriters Laboratories for the specific purpose and comply with the following standards:

1. ANSI/TIA/EIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises.
2. ANSI/TIA/EIA-568-C.1 – Commercial Building Telecommunications Cabling Standard.
3. ANSI/TIA/EIA-568-C.2 – Balanced Twisted Pair Telecommunications Cabling and Components Standard.
4. ANSI/TIA/EIA-568-C.4 – Standard on Coaxial Cabling Components.
5. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces.
6. ANSI/TIA/EIA-606-A – The Administrative Standard for the Telecommunications Infrastructure of Commercial Building.
7. “Telecommunications Distribution Methods Manual” published by the Building Industry Consulting Services International (BISCI).

1.6 WARRANTY

A. All performance and applications warranties shall be channel rated. Contractor shall warrant all materials and workmanship for a period of five (5) years from date of Owner acceptance.

PART 2 - PRODUCTS

2.1 PRODUCT STANDARDS

A. General:

1. This section is designed to provide the Contractor with a minimum standard of quality and functionality for the products used for telecommunications infrastructure.
2. Products required by the Drawings but not enumerated will be evaluated as a performance specification based on the information provided on the Drawings.

2.2 CABLES

A. General:

1. All cables on this Project shall be color-coded. Refer to the specifications section 27 0553 “Identification for Communications Systems” for color coding requirements. Coordinate Cable Color Code Scheme with Owner's Representative.
2. CMP (OFNP) and CMR (OFNR) references below are as required by the NEC published by the National Fire Protection Association.

a. Cables not specifically identified otherwise, shall be provided with CMP classification.

B. Manufacturers: Subject to compliance with requirements, provide products in compliance with University Premise Distribution Standards:

1. Berk-Tek CMP-00423BKTE-6U-01 (White Jacket)
2. Berk-Tek CMP-00423BKTE-6U-06 (Blue Jacket)

C. Twisted Pair Cables:

1. Electrical Requirements:

a. All twisted pair cable is required to have the appropriate Category classification as defined by EIA/TIA/ANSI 568C. The compliance to these electrical characteristics must be third party verified by the manufacturer.

2. Construction:

a. All Twisted pair cable will be properly constructed for the environmental conditions and to meet all applicable codes. Owner requires that all horizontal cable be plenum rated.
b. Premise distribution four pair, data cables:

1) Fully ANSI/EI/TIA 568C.1 Category 6 compliant.

2) Cable shall have two individual insulated 24 AWG solid copper conductors formed into a twisted pair.
3) Cable must be constructed of four individually insulated Unshielded Twisted Pairs (UTP).
4) The cable construction must be available in plenum (CMP) and non-plenum riser (CMR) rated constructions.
5) This cable construction is used in indoor pathways primarily as horizontal cabling but may also be used as backbone cable.

c. Premise distribution four pair, voice cables:

1) Fully ANSI/EI/TIA 568C.1 Category 6 compliant.
2) Cable shall have two individual insulated 24 AWG solid copper conductors formed into a twisted pair.
3) Cable must be constructed of four individually insulated Unshielded Twisted Pairs (UTP).
4) The cable construction must be available in plenum (CMP) and non-plenum riser (CMR) rated constructions.
5) This cable construction is used in indoor pathways primarily as horizontal cabling but may also be used as backbone cable.

2.3 TERMINATION HARDWARE

A. General:

1. Suggested layout of termination hardware is indicated on the Drawings. Contractor shall coordinate layout of termination hardware with the Owner's Representative before installation.
2. Provide one single manufacturer for all twisted-pair termination hardware used together in a permanent link or whenever a Category Certification is required.
3. Contractor shall provide Owner warranty documentation at project close out.
4. All devices shall be UL listed as required by the NEC published by the National Fire Protection Association.
5. Each RJ-45 termination device shall be color coded for both T568A and T568B wiring scheme.
6. All RJ-45 twisted pair termination devices are required to have the appropriate Category classification as defined by EIA/TIA/ANSI 568B. The compliance to these electrical characteristics must be third party verified by the manufacturer. Part 1 of this specification Section will define the appropriate Category for each cable.

B. Manufacturers:

1. Siemon CT-C6 series

C. Station Outlet:

1. The following basic termination devices are available and recognized for this Project.

a. Flush Faceplate – Single Gang:

1) Four position minimum on each faceplate.
2) Stainless steel with identification windows.
3) Be mounted in a 4"x4"x2-1/8" outlet box.
4) Utilize module inserts as specified below.

b. Faceplate Blank Insert:

1) Provide blanks for all un-used positions in faceplates, surface boxes, or jack frames.
2) Color to match outlet faceplate as described above.

c. Category CAT 6 module insert RJ-45:

1) Fully compliant ANSI/TIA/EIA 568B RJ45 modular jack.
2) Color shall be Red for all locations identified as being voice locations.
3) Color shall be Blue for all locations identified as data locations.

D. Communications Room Equipment:

1. The following basic termination devices are available and recognized for this Project.

a. Voice: 110 Block Ortronics #S110DW2-100 with 110RD2-200-19 Mounting Bracket.
b. Data: 24 port Ortronics #PHD66U24 or 48 port Ortronics #PHD66U48

PART 3 - EXECUTION

3.1 GENERAL

A. Provide, test, and label all cables and terminations devices as described below and as shown on the plans.

B. The cable distance between the termination point with a Communications Room(s) and the station outlet(s) shall be no greater than 90 meters (295 ft).

C. The total channel distance shall not exceed 100 meters (328 feet) distance between equipment in the communications room and station equipment, including all patch cables and station attachment cables

D. All system cables shall be continuous between points of termination, without splices.

3.2 INSTALLATION

A. Coordination:

1. Review and coordinate proper pathways prior to installation.

B. General:

1. Cable routing shall follow building structure lines and shall be installed with adequate length to reach to any location within the equipment racks with at least 5 feet of service loop at the equipment room end.
2. At point of final terminations, excess cable and the service loop shall be stored and dressed neatly.

a. Within a Communications Room the service loop shall dressed and stored within the cable tray.

3. Strain relief techniques shall be applied to all cables to lessen the risk of physical cable damage and to provide proper aesthetic value.
4. Route all cabling and pathways parallel to building surfaces and at 90 degrees angles to building surfaces such as columns, trusses, rafters, etc.
5. Wiring shall be free from grounds, shorts, opens, and reversals.

C. Protection:

1. Maintain protection of all cabling throughout the entire duration of the project. Cabling shall not be left hanging or coiled where it potentially obstructs the Work of other trades. Cabling shall be bundled, supported, and protected in a non-obstructing manner out of the way of other trades any time it is determined necessary to ensure the safety or personnel and protection of the cable.
2. Do not terminate cables designated for different services onto the same patch panel unless otherwise clearly indicated on the drawings. Coordinate with Owner before any terminations are made.
3. No not exceed minimum bend radius or pulling tension specifications set forth by the product manufacturer.
4. Cable Separation and Organization:

    a. Horizontal cables of all service types (e.g., Voice, Data, Control, RF, etc.) shall be organized and kept segregated within cable trays, ladder rack, wire management and other pathways to the degree physically possible.
    b. Cables of different services shall not be intertwined.
    c. Terminate all cabling on specified termination hardware in numerical order and on specified outlets.

D. Station Outlet Installation:

1. Back Box Requirements for All Station Outlets:

    a. All outlets shall be installed at as indicated on the drawings.
    b. All outlet boxes shall be a minimum of 4 inches square and 2-1/8 inches deep with a single or double gang plaster ring as required per the quantity of jacks required at the station outlet.
    c. 5 inch boxes are not R&B standard and will add considerable cost to the project. Consider 5 inch boxes for I3A projects where 3.28 feet of slack cable is required at each outlet or when Cat 6A cable is being used.
    d. A 1-inch conduit shall be routed from the back box to the nearest cable tray. Provide plastic, insulating bushing on conduit ends to protect cabling.
    e. All station outlet back boxes shall be secured to the building structure using manufacturer approved means and methods.

E. Labeling:

1. Label in accordance with specification section 27 0553 “Identification for Communications Systems” and University Standards.

F. Use of Raceways:

1. Install cabling within conduit and as indicated on the drawings.
2. Cabling shall be installed in a concealed manner. Cables may be exposed only in the following areas;

    a. Equipment Rooms.

b. Telecommunications Rooms.
c. Building spaces equipped with cable trays or J-hook pathway, but without finished ceilings to conceal the cables.
d. Attics.

3. Provide continuous conduit raceways for cable routing in all inaccessible areas. Where junction or pull points are required, provide access panels in concealing surfaces to allow access to junction and/or pull points. Coordinate access panel locations with the general contractor.
4. Install cabling in cable tray and ladder rack where specified and/or indicated on the drawings.
5. Support cables using approved products and methods whenever conduit, surface raceway and cable tray are not specified. Cable supports shall be attached directly to building structure.
6. Refer to specifications sections 260533 “Raceways”, and 260536 “Cable Trays” for additional requirements.

G. Cabling on Backboards and in Equipment Racks:

1. Neatly dress, support, and securely attach all cabling.

H. Termination:

1. Terminate each end of every cable provided.
2. Terminate each cable from a station outlet in numerical order on adjacent ports on the specified termination hardware within the appropriate Communications Room.
3. Terminate cables using the tools and connectors specified and as recommended by the cable/connector manufacturer.
4. Terminate all voice cables with T568B wiring scheme.
5. Terminate all data cables with T568B wiring scheme.
6. At all voice and data cable terminations, the cable sheath shall be not be pulled back or removed more that 1 inch from the end of the cable.

I. Separation from Sources of Interference:

1. Route cables at least (4 foot) from motors or transformers, (1 foot) from conduit and cables used for AC power distribution, and (5 inches) from fluorescent lighting fixtures.

J. Cable Supports:

1. Where cabling is not supported by cable tray or conduit, provide necessary cable support and/or as indicated on the drawings. Provide nylon cable tie at the support to contain cabling within the support. Do not bundle cable between supports. Provide cable support as specified at intervals not to exceed 5 feet. Do not secure cabling to the support.

K. Horizontal Cabling:

1. Locate telecommunications outlets so that the cable assembly required to reach work area equipment will be no more than (15 feet) long.
2. Provide 6 inches service loops on all horizontal cables at the station end coiled in the station outlet back box or raceway. Do not violate the minimum bend radius of the cable.
3. Provide service loop at the Equipment Room/Telecommunications Room end of **[5]** feet coiled above the ceiling or neatly bundled in cable tray/ladder rack above the cabinet/rack.
4. Install telecommunications outlets securely at work area locations.

5. Any necessary electrical components (e.g., impedance-matching devices) at outlets shall be located outside the faceplate via a standard plug connection.

3.3 TESTING

A. All cables shall be fully tested and verified compliant with these specifications.

1. See: Specification section 270810, “Verification and Testing of Structured Cabling” for UTP Horizontal performance testing parameters and procedures.

B. The Owner reserves the right to have a representative present during any or all testing procedures. Verification testing will be performed at or near Project completion by the Contractor for quality assurance.

C. Upon verification testing, if the Consultant or Owner finds the test results do not match the Contractor’s results, the Consultant or a third party may, at the Owner’s request, retest all of the cabling and submit those results to the Owner and deduct the verification testing costs from the Contractor’s Contract amount.

END OF SECTION 271513

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire Alarm and Detection Systems.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 PERFORMANCE REQUIREMENTS

A. The fire alarm design documents and this specification section describe the minimum required features, material quality and operational requirements of the fire alarm system. These documents do not depict every connection to be made and wire to be installed. The Vendor and Contractor are solely responsible for determining all wiring, programming, interconnections and additional equipment required to create a complete and fully functional fire alarm system, based on the equipment and performance characteristics described within these documents.

B. Provide all components, devices, hardware, software, programming, peripheral devices, extension components, conduit, wiring, etc., required to integrate the existing fire alarm system with the new fire alarm system. Required components include, but are not limited to, initiating devices and circuits, signaling devices and circuits, notification devices and circuits, monitoring devices and circuits, power supplies, batteries, auxiliary devices and control circuits for other building systems such as dampers, magnetic door hold open devices, fan shut down, etc. Extend the existing fire alarm in a manner that the existing fire alarm system’s functionality and annunciation is equivalent to the existing conditions unless otherwise noted. Upon completion of construction, the complete fire alarm system shall function as a single system, able to be reset from any single reset location point and annunciated at any annunciator location.

C. Device layouts and limited equipment have been shown on the construction documents. Additional equipment, wiring, components, etc required to create a complete and fully functional system has not been shown and is the responsibility of the Contractor. Shop drawing submittals shall indicate all requirements to create said fire alarm system.

1.5 SUBMITTALS

A. General Submittal Requirements:

1. Failure to comply with all of the requirements within specification 26 0500 and within this specification section will result in the submitted shop drawing being rejected without review. All listed requirements must be submitted within a single submittal package.
2. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect/Engineer.
3. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified fire-alarm technician, Level III minimum.
c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product indicated on drawings and required to complete installation if not indicated on drawings. Indicate part numbers being ordered for each equipment or component variation required. If device or equipment is shown on construction documents, indicate corresponding fire alarm symbol at the top of each product data sheet.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include CAD floor plans indicating the complete layout of the entire system, including auxiliary equipment, wiring and device addresses.

a. A legend shall be provided to indicate which fire alarm symbols correspond with construction document fire alarm symbols, if different.

2. Include a complete fire alarm riser diagram indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring.
3. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
4. Include voltage drop calculations for notification appliance circuits.
5. Include battery-size calculations including total available capacity, used capacity and future capacity available.
6. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
7. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
8. Manufacturer wiring requirements, such as size, type and manufacturer.
9. Photocopy of NICET certification of person overseeing the preparation of fire alarm drawings, shop drawings, installation and testing.
10. Stamp and signature of Professional Engineer overseeing fire alarm design shall be required on drawings as required to comply with local or state regulations.

D. Installation and maintenance manuals per Section 260500.

E. Field quality-control reports.

F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

4. Provide shop drawings as reviewed by the Architect/Engineer and Authority Having Jurisdiction.
5. Provide hardcopy and electronically reproducible CAD floor plans indicating location of fire alarm devices, wiring and associated addresses.

G. Software and Firmware Operational Documentation:

1. Device address list.

H. Project Record Documents:

1. Submit record documents per Section 260500.
2. Provide a CAD drawing of each building area depicting each device location and address. Labeling of devices on drawings shall be consistent with labeling in the field. Scale CAD drawings no smaller than 1/16 inch = 1 foot-0 inch.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: A factory authorized, licensed electrical or security contractor with minimum 5 years experience in the design, installation and maintenance of fire alarm systems by fire alarm system manufacturer specified and selected. Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain system from single source from single manufacturer. Components shall be compatible with and operate as an extension of existing system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.7 SYSTEM DESCRIPTION

A. UL-certified automatic and manual addressable fire alarm system consisting of multiplexed signal transmission, dedicated to fire-alarm service only. Compliant with NFPA 72.

B. Alarm Indication: By synchronized sounding of horns and synchronized flashing of strobes. Horn and visual signals shall be synchronized throughout the facility.

1.8 SEQUENCING AND SCHEDULING

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

B. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

C. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected equipment and wiring.

1.9 WARRANTY

A. Provide one (1) year warranty for all labor and materials from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products compatible with existing devices installed within facility. Devices installed in finished areas should match existing devices.

2.2 SIGNALING LINE CIRCUIT DEVICES

A. Smoke Detectors:

1. Comply with UL 268.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base in locations shown on drawings with all mounting hardware provided. Provide terminals in the fixed base for connection to building wiring.

4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
5. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
6. Photoelectric Smoke Detector: Detector shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
7. Detector shall be directly connected to a SLC loop. Each detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
8. Dual status LEDs shall be provided on each smoke detector to indicate the detector is operational and in regular communication with the control panel, or in an alarm condition.
9. Each detector shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel.

2.3 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

B. All wall-mounted audible, visual and combination notification devices shall be red in color, with white, with lettering to match existing.

C. Audio Horn Devices:

1. Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille.
2. Device shall be capable of providing a ‘high’ and ‘low’ dBA setting via an integral selector switch.
3. Comply with UL 464.
4. Horns shall produce a sound-pressure level of 85 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol. Sound pressure levels shall not exceed 120dBA in an occupied area.

D. Visual Notification Appliances:

1. Xenon strobe lights or equivalent in compliance with UL 1971 and ADAAG with clear or nominal clear lens for fire alarm systems.
2. The maximum pulse duration shall be two-tenths of one second (0.2 second) with a maximum duty cycle of 40 percent. The flash rate shall be 1 Hertz.
3. Visual alarm notification appliances shall be flash in a temporal pattern and fully synchronized with all other units.
4. Rated Light Output:

    a. 15/30/75/110 Candela, selectable in the field, as indicated on drawings.

5. Mounting: As indicated on drawings.
6. Strobe Leads: Factory connected to screw terminals.

E. Combination Audible/Visual Notification Appliances:

1. Single device with integral audible and visual notification, meeting the requirements for each component (audible and visual) per this specification.

2.4 WIRING

A. All fire alarm wiring and cables shall be furnished and installed by the Contractor.

B. Wiring shall be in accordance with local, state and national codes. Number and size of conductors shall be as recommended by the fire alarm system manufacturer.

C. All analog voice speaker and analog telephone circuits shall utilize twisted/shielded pair to eliminate cross talk.

D. All wiring and cables shall be UL listed and labeled as complying with NFPA 70 Article 760.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 70, NFPA 72, local and state codes and manufacturer recommendations for installation of fire-alarm equipment.

B. Connection to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connecting new equipment to existing control panel in existing part of the building.
2. Connecting new equipment to existing monitoring equipment at the supervising station.
3. Provide all items, wiring, devices, components, programming, etc., to modify, supplement and expand the existing fire alarm system as necessary to extend existing fire alarm system. New components shall be capable of merging with existing configuration without degrading the performance of either system.
4. After acceptance of the new fire alarm system, remove existing, disconnected fire alarm equipment and restore damaged surfaces.

C. Devices specified to be surface mounted shall be mounted on a manufacturer provided backbox, painted to match the color of the device. The backbox shall be the same size and shape of the device, and must not have visible knockouts.

D. Signaling Line Circuit Devices:

1. General:

a. Do not install pull stations, fire alarm annunciators and signaling appliances before all dust producing construction in the area has ceased.
b. Coordinate the location of all ceiling devices with luminaires, sprinkler heads, piping, diffusers, grilles and other obstructions to maintain a neat and operable operation. Mounting locations and spacing must in accordance with NFPA 72.
c. Center ceiling mounted devices within each ceiling tile where installed in a grid type ceiling. Devices installed within hard ceilings shall be arranged in a neat and uniform pattern.
d. Provide a means of isolating addressable devices connected to the SLC so that connection to no more than 50 devices would be lost by single fault on a pathway, per NFPA-72 chapter 23.6.
e. Provide a means of isolating addressable devices connected to the SLC so that connection to the devices in no more than one zone would be lost by a single fault on a pathway, per NFPA-72 chapter 23.6.

2. Smoke Detectors:

a. Detector heads shall not be installed until after the final construction cleaning, unless required by the Authority Having Jurisdiction. If detector heads must be installed prior to final cleaning, they may not be installed until they can be connected to a fully functional fire alarm control panel.
b. All smoke detectors must be installed in an accessible location, including in-duct smoke detectors. Provide access panels as required. Coordinate with General Contractor.
c. Smoke detectors must be located at least 3 feet-0 inches from each supply air diffuser and return grille.
d. Smoke detectors shall be installed at least 12 inches from any part of a lighting fixture.

E. Notification Appliance Devices:

1. Devices shall be located where shown on drawings.
2. Wall mounted devices shall be installed on flush-mounted backboxes.
3. Ceiling mounted devices shall be installed flush with ceiling, centered within ceiling tile if installed in a grid-type system. Devices installed within hard ceilings shall be arranged in a neat and uniform pattern.
4. Where devices are to be installed in a location having a ceiling exceeding a 30 foot-0 inch height, provide stem-mounting device and support hardware, installed such that the entire device is below 30 feet-0 inches.

3.2 WIRING

A. Fire alarm wiring shall be provided by the Contractor in accordance with the manufacturer’s recommendations and in compliance with the National Fire Codes.

B. Connect all components together for a completely functional ready to operate system as shown on the drawings, as specified herein and as directed by the manufacturer.

C. Install all fire alarm wiring in conduit.

1. Wiring not associated with fire alarm detection, alarm or auxiliary fire protection functions shall not be routed in fire alarm conduits.

D. Fire alarm wiring splices shall be avoided to the extent possible. If needed, splices may only be made in accessible junction boxes, compliant with NFPA 70.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Paint all junction boxes associated with the fire alarm system red. Identify SLC and NAC circuit on junction box cover.

C. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Differentiate the following circuit types by using different conductor colors with an overall red jacket.

1. Alarm Circuits.
2. Supervisory Circuits.
3. Initiating Circuits.
4. Notification Circuits.
5. Door Release.
6. Central Station.
7. DC Power Supply.
8. Power Branch Circuits.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100 and manufacturer written requirements. Install a ground wire from main service ground to fire alarm control unit.

B. For audio circuits, minimize the following to the greatest extent possible: ground loops, common mode returns, noise pickup, cross talk and other impairments.

3.5 SEQUENCES OF OPERATION

A. General:

1. The existing sequence of operation for the system shall be maintained.

B. Panel/Annunciator Alarm, Trouble, Supervisory Indication:

1. Respective system Alarm, Trouble or Supervisory LED indicator light shall cycle on/off at the following locations:

    a. Fire Alarm Control Panel.
    b. Remote Annunciator Locations.

2. Appropriate signal shall be transmitted to the central station via the digital communicator.
3. Event date, time and type of occurrence shall be recorded within the Fire Alarm Control Panel event history.

C. Fire Alarm Visual Alarm Sequence:

1. Visual alarms throughout the building shall flash. Strobes within the building shall be synchronized.

D. Fire Alarm Audible Alarm Sequence:

1. Audible alarms throughout the building shall sound.

2. Audible alarms within the floor where the alarm signal was initiated along with the adjacent areas and floors shall sound.

3.6 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Owner’s representative and authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Test fire alarm system in accordance with NFPA 72 Chapter 14, local Fire Marshal requirements and local building codes.
2. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Contractor and Owner shall coordinate actual room numbers to be used within facility. Final room numbers should be used for fire alarm system programming and record documents.

3.7 SYSTEM TRAINING

A. Authorized manufacturer representative shall provide the following minimum on-site training to instruct the Owner’s representative as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

1. System Operators: One day.
2. Graphical User Interface Operation and Editing: One day.

B. The contractor and/or the system manufacturer’s representatives shall provide a typewritten “Sequence of Operation.”

END OF SECTION 283111