SECTION 000101
TITLE PAGE

WAYNE STATE UNIVERISTY
COHN NURSING CLASSROOM RENOVATION

PROJECT MANUAL
JUNE 27, 2024
ISSUED FOR BID AND PERMIT

NORR

Project Number: ED2024-0063

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SECTION 011000
SUMMARY

PART 1 GENERAL

1.01 RELATED

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

1.02 PROJECT

A. Project Name: Cohn Nursing Classroom Renovation.
   1. Project Location: Richard Cohn Memorial Building, 5557 Cass Ave, Detroit, MI 48202

B. Owner's Name: Wayne State University.
   1. 1. Owner's Representative: Airel Suarez , 313.577.3038, hq2836@wayne.edu

C. Architect's Name: NORR,LLC 150 W, Jefferson Ave., Suite 1300, Detroit, MI 48226
   1. 1. Architect's Representative: Valentino Mancini, Project Manager, (313) 324-3156 valentino.mancini@norr.com

D. The Project consists of the renovation lcoated in the Cohn College of Nursing Building. The Work includes, but is not limited the reconfiguration of (3) three existing classrooms and corridor into (2) two new classrooms. The work includes mechanical, electrical and audio visual demolition and new work as indicated on drawings.The classroom renovation area of work size is +/- 4,000 sf.

1.03 CONTRACT DESCRIPTION

A. Project Will be constructed under a single prime contract.

1.04 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 024100.

1.05 WORK BY OWNER

A. Owner will supply the following for Installation by Contractor.
   1. Cylinder cores
   2. Owner Furnish Material

1.06 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.07 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
   1. Locate and conduct construction activities in ways that will limit disturbance to site.

B. Arrange use of site and premises to allow:
   1. Work by Others.

C. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Utility Outages and Shutdown:

1. Prevent accidental disruption of utility services to other facilities.
2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 24 hours notice to Owner and authorities having jurisdiction, unless it is an emergency.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 011000

SECTION 012000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

1.03 SCHEDULE OF VALUES

A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

B. Forms filled out by hand will not be accepted.

C. Include in each line item, the amount of Allowances specified in this section

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Balance to Finish.
   9. Retainage.

E. Execute certification by signature of authorized officer.

F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

H. Submit one electronic and three hard-copies of each Application for Payment.

I. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 013000.
   2. Construction progress schedule, revised and current as specified in Section 013000.
   3. Current construction photographs specified in Section 013000.
   4. Project record documents as specified in Section 017800, for review by Owner which will be returned to the Contractor.

1.05 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.

B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.

D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.

1.06 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 017000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012000

SECTION 012300
ALTERNATES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Description of Alternates.

1.03 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF ALTERNATES

A. Alternate No. 1
   1. Base Bid Item: Include WP-1 Acoustic Wood Wall Slat Panel as indicated in drawings.
   2. Alternate Item: Delete WP-1 Acoustic Wood Slat Wall Panel as indicated on drawings. Replace with Zintra timber plus sticks spotted gum Acoustic felt panels. Color by Architect

B. Alternate No. 2
   1. Base Bid Item: Include CC-1 Aluminun Metal Column Cover as indicated in drawings
   2. Alternate Delete CC-1 Aluminun Metal Column Cover. Replace with 5/8" Gypsum board on 3 5/8" Metals studs from finished floor to underside of structure. Provide Acrovyn corners guards typcial for (4) corners with flat stock Arocyn between corners on all fours side of column with wall base as indicated indrawings. Prime and Paint Gypsum board column finish.

C. Alternate No. 3
   1. Base Bid Item: Include ACT-1 cloud ceiling, aluminum trim, and the prime & painting of underside of deck, piping and HVAC equipment in Classroom 101 as indicated on drawings.
   2. Alternate Delete ACT-1 cloud ceiling and aluminum trim from Large Classroom 101 as well a Prime and Paintng of underside deck, piping and HVAC euipment above new ceiling finish. Replace with square lay in ACT-1 ceiling and suspension system. Provide Gypsum bulkhead between ACT Ceiling and radiant panel for entire length of classroom similar to detail 1/A70-01

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012300

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SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
      a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
   2. No specific form is required. Contractor's Substitution Request documentation must include the following:
      a. Project Information:
         1) Official project name and number, and any additional required identifiers established in Contract Documents.
      b. Substitution Request Information:
         1) Discrete and consecutive Substitution Request number, and descriptive subject/title.

2) Indication of whether the substitution is for cause or convenience.
3) Issue date.
4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
5) Description of Substitution.
6) Reason why the specified item cannot be provided.
7) Differences between proposed substitution and specified item.
8) Description of how proposed substitution affects other parts of work.

c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
1) Physical characteristics.
2) In-service performance.
3) Expected durability.
4) Visual effect.
5) Warranties.
6) Other salient features and requirements.
7) Include, as appropriate or requested, the following types of documentation:
(a) Product Data:
(b) Samples.
(c) Certificates, test, reports or similar qualification data.
(d) Drawings, when required to show impact on adjacent construction elements.

d. Impact of Substitution:
1) Savings to Owner for accepting substitution.
2) Change to Contract Time due to accepting substitution.

D. Limit each request to a single proposed substitution item.
1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Time Restrictions:
1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

B. Substitutions will not be considered under one or more of the following circumstances:
1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
2. Without a separate written request.
3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

END OF SECTION 012500

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SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Construction progress schedule.

G. Progress photographs.

H. Coordination drawings.

I. Submittals for review, information, and project closeout.

J. Number of copies of submittals.

K. Requests for Interpretation (RFI) procedures.

L. Submittal procedures.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

1.04 PROJECT COORDINATOR

A. Project Coordinator: Owner.

B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for construction access, traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Project Coordinator.

D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 011000 - Summary.

F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

G. Make the following types of submittals to Architect through the Project Coordinator:

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
   7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is:

C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

A. Project Coordinator will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.

4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
5. Designation of personnel representing the parties to Contract, Owners Representative and Architect.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

A. Project Coordinator will schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

A. Project Coordinator will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

B. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

C. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.

6. Maintenance of progress schedule.
7. Corrective measures to regain projected schedules.
8. Planned progress during succeeding work period.
9. Maintenance of quality and work standards.
10. Effect of proposed changes on progress schedule and coordination.
11. Other business relating to work.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE

A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

C. Within 10 days after joint review, submit complete schedule.

D. Submit updated schedule with each Application for Payment.

3.06 PROGRESS PHOTOGRAPHS

3.07 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:

B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
   2. Prepare in a format and with content acceptable to Owner.
   3. Prepare using an electronic version of the form appended to this section.
   4. Prepare using software provided by the Electronic Document Submittal Service.

3.08 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.09 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.

6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.10 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.11 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.12 SUBMITTAL PROCEDURES

A. General Requirements:
1. Use a single transmittal for related items.
2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
3. Transmit using approved form.
a. Use Contractor's form, subject to prior approval by Architect.
4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
6. Schedule submittals to expedite the Project, and coordinate submission of related items.
a. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
b. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
7. Provide space for Contractor and Architect review stamps.
8. When revised for resubmission, identify all changes made since previous submission.
9. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
10. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:
1. Submit only information required by individual specification sections.

2. Collect required information into a single submittal.
3. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.13 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "Approved", or language with same legal meaning.
b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
2. Not Authorizing fabrication, delivery, and installation:

E. Architect's and consultants' actions on items submitted for information:
1. Items for which no action was taken:
a. "Received" - to notify the Contractor that the submittal has been received for record only.
2. Items for which action was taken:
a. "Reviewed" - no further action is required from Contractor.

END OF SECTION 013000

SECTION 014000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Contractor's design-related professional design services.

F. Control of installation.

G. Mock-ups.

H. Manufacturers' field services.

I. Defect Assessment.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2024.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2023.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2023.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.

G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.

1.04 DEFINITIONS

A. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
   1. Design Services Types Required:

B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.05 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.

C. Scope of Contractor's Professional Design Services: Provide for the following items of work:

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.08 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.09 TESTING AND INSPECTION AGENCIES AND SERVICES

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TESTING AND INSPECTION

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.

3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
a. To provide access to Work to be tested/inspected.
b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
c. To facilitate tests/inspections.
d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.04 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION 014000

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Security requirements.

F. Waste removal facilities and services.

G. Project identification sign.

1.03 RELATED REQUIREMENTS

A. Section 015100 - Temporary Utilities.

B. Section 015500 - Vehicular Access and Parking.

1.04 TEMPORARY UTILITIES - SEE SECTION 015100

A. Owner will provide the following:
   1. Electrical power and metering, consisting of connection to existing facilities.
   2. Water supply, consisting of connection to existing facilities.

1.05 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:

1.06 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Contractor to provide own Restroom facilites. Owner to provide power and water.

C. Maintain daily in clean and sanitary condition.

1.07 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.08 FENCING

A. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.09 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.10 SECURITY - SEE SECTION 013553

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.11 VEHICULAR ACCESS AND PARKING - SEE SECTION 015500

A. Coordinate access and haul routes with governing authorities and Owner.

B. Provide and maintain access to fire hydrants, free of obstructions.

C. Provide means of removing mud from vehicle wheels before entering streets.

D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.12 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.13 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated on drawings.

B. Erect on site at location indicated.

C. No other signs are allowed without Owner permission except those required by law.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 015000

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

B. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

C. Section 017419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.02 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:

C. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 016116.
   2. If wet-applied, have lower VOC content, as defined in Section 016116.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 016000

SECTION 016116
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Content, including General and Supplementary Conditions and Divisions 01 Specficiations Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

1.03 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittal procedures.

1.04 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
   1. Interior paints and coatings applied on site.
   2. Interior adhesives and sealants applied on site, including flooring adhesives.
   3. Flooring.
   4. Composite wood.
   5. Products making up wall and ceiling assemblies.
   6. Thermal and acoustical insulation.
   7. Other products when specifically stated in the specifications.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
   1. Interior paints and coatings applied on site.
   2. Interior adhesives and sealants applied on site, including flooring adhesives.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
   1. Concrete.
   2. Clay brick.
   3. Metals that are plated, anodized, or powder-coated.
   4. Glass.
   5. Ceramics.
   6. Solid wood flooring that is unfinished and untreated.

1.05 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2018).

C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.

D. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

E. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.07 QUALITY ASSURANCE

A. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. VOC-Content-Restricted Products: VOC content not greater than required by the following:
   1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
   2. Joint Sealants: SCAQMD 1168 Rule.
   3. Paints and Coatings: Each color; most stringent of the following:
      a. 40 CFR 59, Subpart D.
      b. SCAQMD 1113 Rule.
      c. CARB (SCM).

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION 016116

SECTION 016116.01
ACCESSORY MATERIAL VOC CONTENT CERTIFICATION FORM

FORM

1.01 IDENTIFICATION:

A. Project Name: _____

B. Project No.: _____

C. Architect: _____

1.02 USE OF THIS FORM:

A. Because installers are allowed and directed to choose accessory materials suitable for the applicable installation, there is a possibility that such accessory materials might contain VOC content in excess of that permitted, especially where such materials have not been explicitly specified.

B. Contractor is required to obtain and submit this form from each installer of work on this project.

C. For each product category listed, circle the correct words in brackets: either [HAS] or [HAS NOT].

D. If any of these accessory materials has been used, attach to this form product data and MSDS sheet for each such product.

1.03 VOC CONTENT RESTRICTIONS ARE SPECIFIED IN SECTION 016116.

2.01 PRODUCT CERTIFICATION

A. I certify that the installation work of my firm on this project:
   1. [HAS] [HAS NOT] required the use of any ADHESIVES.
   2. [HAS] [HAS NOT] required the use of any JOINT SEALANTS.
   3. [HAS] [HAS NOT] required the use of any PAINTS OR COATINGS.
   4. [HAS] [HAS NOT] required the use of any COMPOSITE WOOD or AGRIFIBER PRODUCTS.

B. Product data and MSDS sheets are attached.

3.01 CERTIFIED BY: (INSTALLER/MANUFACTURER/SUPPLIER FIRM)

A. Firm Name: _____

B. Print Name: _____

C. Signature: _____

D. Title: _____ (officer of company)

E. Date: _____

END OF SECTION 016116.01

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SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 RELEATED DOCUMENTS

A. Drawings and general provisions of the Contract, inculding General and Supplementary Conditions and Division 01 Specifications Section, apply to this Section.

1.02 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of Owner personnel.

H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

I. General requirements for maintenance service.

1.03 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 015000 - Temporary Facilities and Controls: Temporary exterior enclosures.

C. Section 015000 - Temporary Facilities and Controls: Temporary interior partitions.

D. Section 015100 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.

E. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

F. Section 078400 - Firestopping.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

1.05 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.

B. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 PROJECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.07 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.

2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations indicated on drawings.

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

D. Services (Including but not limited to HVAC, Plumbing, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

E. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

H. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

I. Clean existing systems and equipment.

J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

K. Do not begin new construction in alterations areas before demolition is complete.

L. Comply with all other applicable requirements of this section.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 017900 - Demonstration and Training.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.12 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION 017000

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SECTION 017419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Contractor Reporting Responsibilities: Submit periodic Waste Disposal Reports; report landfill disposal, incineration, recycling, salvage, and reuse regardless of to whom the cost or savings accrues; use the same units of measure on required reports.

E. Develop and follow a Waste Management Plan designed to implement these requirements.

F. The following sources may be useful in developing the Waste Management Plan:

G. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.03 RELATED REQUIREMENTS

A. Section 012500 - Substitution Procedures.

B. Section 013000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. Section 015000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

D. Section 016000 - Product Requirements: Waste prevention requirements related to product substitutions.

E. Section 016000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

F. Section 017000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.04 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Waste Management Plan: Include the following information:

1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

C. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to Owner.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   4. Incinerator Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project delivered to incinerators.
      c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   5. Recycled and Salvaged Materials: Include the following information for each:
      a. Identification of material, including those retrieved by installer for use on other projects.
      b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
      c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
      e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
   6. Material Reused on Project: Include the following information for each:
      a. Identification of material and how it was used in the project.
      b. Amount, in tons or cubic yards (cubic meters).
      c. Include weight tickets as evidence of quantity.
   7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 016000 and Section 012500.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 016000:
   1. Relative amount of waste produced, compared to specified product.
   2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
   3. Proposed disposal method for waste product.
   4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 013000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 015000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 016000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 017000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Prebid meeting.
   2. Preconstruction meeting.
   3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. Provide containers as required.
   2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 017419

SECTION 017800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 RELATED DOCMENTS

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

1.02 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.03 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Individual Product Sections: Specific requirements for operation and maintenance data.

C. Individual Product Sections: Warranties required for specific products or Work.

1.04 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Changes made by Addenda and modifications.

F. Record Drawings: Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

B. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

C. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

END OF SECTION 017800

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SECTION 017900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Project Commissiong is the responasbility of the Contractor. Reference Wyane State Unviesty Construction Design Statndards, Second Revision dated, 20212 for Commissiong requirements.

C. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.

1.03 RELATED REQUIREMENTS

A. Section 017800 - Closeout Submittals: Operation and maintenance manuals.

B. Section 019113 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.05 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 017900

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SECTION 019113
GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Project Commissiong is the responasbility of the Contractor. Reference Wyane State Unviesty Construction Design Statndards, Second Revision dated, 20212 for Commissiong

B. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the Owner’s operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

1.03 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Fire Protection Systems.

C. HVAC System, including:
   1. Major and minor equipment items.
   2. Piping systems and equipment.
   3. Ductwork and accessories.
   4. Terminal units.
   5. Control system.
   6. Sound control devices.
   7. Vibration control devices.

D. Electrical Systems:
   1. Emergency power systems.
   2. Uninterruptible power systems.
   3. Lighting controls other than manual switches.

E. Electronic Safety and Security:
   1. Security system, including doors and hardware.
   2. Fire and smoke alarms.

F. Communications:
   1. Voice and data systems.
   2. Public address/paging.

G. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

H. Sound Transmission Class-rated interior partitions.

I. Indoor Air Quality Procedures: The Commissioning Authority will coordinate; Contractor will execute; see Section 015719 - Temporary Environmental Controls.

1.04 RELATED REQUIREMENTS

A. Section 015719 - Temporary Environmental Controls: Precautions and procedures; smoking room testing; building flush-out.

B. Section 017800 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

1.05 REFERENCE STANDARDS

A. ASHRAE Std 202 - Commissioning Process for Buildings and Systems; 2018, with Addendum (2023).

B. ASTM E336 - Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings; 2023.

C. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization; 2019.

D. CSI/CSC MF - Masterformat; 2016.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect; in that case, submit to Architect first.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.
   5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.

B. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
   1. Manufacturer's product data, cut sheets, and shop drawings.
   2. Manufacturer's installation instructions.
   3. Startup, operating, and troubleshooting procedures.
   4. Fan and pump curves.
   5. Factory test reports.
   6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.

C. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
   1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F (0.3 degree C) and resolution of plus/minus 0.1 degree F (0.05 degree C).
   2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
   3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
   1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.
   1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
   2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:
   1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
   2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
   3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
   4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.03 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
   1. No sampling of identical or near-identical items is allowed.
   2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
   3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
      a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
      b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
      c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
      d. Serial number of installed unit.
      e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
      f. Sensor and actuator calibration information.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
   1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
   2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
   3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
   4. If any Checklist line item is not relevant, record reasons on the form.
   5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
   6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
   7. Submit completed Checklists to Commissioning Authority within two days of completion.
   8. See Section 017000 - Execution and Closeout Requirements for additional general startup requirements.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
   1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.

2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:
1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:
1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
2. Examples of Functional Testing:

a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.
d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:
1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
2. Verify that sensors with shielded cable are grounded only at one end.
3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F (0.1 degree C) of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:
1. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.
1. Disconnect sensor.
2. Connect a signal generator in place of sensor.
3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.

6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F (0.2 degree C).
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg (340 Pa).
6. Flow Rate, Air: 10 percent of design.
7. Flow Rate, Water: 4 percent of design.
8. AHU Wet Bulb and Dew Point: 2.0 degrees F (1.1 degrees C).

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper to open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:

1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
   a. Major equipment.
   b. Life-safety-critical equipment.
   c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
   1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority’s request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
   2. Other points will be monitored by the Commissioning Authority using dataloggers.
   3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
   4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
   5. Graphical output is desirable and is required for all output if the system can produce it.
   6. Monitoring may be used to augment manual testing.

3.07 FIELD TESTING AND COMMISSIONING OF PARTITIONS FOR NOISE ISOLATION

A. Conduct testing of partitions requiring a specific STC class indicated on drawings and/or in various specifications sections. Comply with ASTM E336 for testing methods, including

requirements of Annex A1 for reduction of flanking sound transmission.

B. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
   1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.
   2. Sealants for remedying flanking sound transmission deficiencies evidenced as excessive air leakage are specified in Section 079200.

3.08 OPERATION AND MAINTENANCE MANUALS

A. See Section 017800 - Closeout Submittals for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION 019113

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SECTION 024100
DEMOLITION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

B. Abandonment and removal of existing utilities and utility structures.

1.03 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

D. Section 017419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Site Plan: Indicate:
   1. Areas for temporary construction and field offices.
   2. Areas for temporary and permanent placement of removed materials.

C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

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

PART 3 EXECUTION

2.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   5. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
   6. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.

7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements to remain in place and not removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

D. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

E. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Comply with requirements of Section 017419 - Construction Waste Management and Disposal.
   2. Dismantle existing construction and separate materials.
   3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

2.02 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

2.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
   1. Verify construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Remove existing work as indicated and required to accomplish new work.
   1. Remove items indicated on drawings.

C. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
   1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.

4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

D. Protect existing work to remain.
   1. Prevent movement of structure. Provide shoring and bracing as required.
   2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch to match new work.

2.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 024100

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SECTION 035400
CAST UNDERLAYMENT

PART 1 GENERAL

1.01 RELATED DOCUMETS

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

1.02 SECTION INCLUDES

A. Liquid-applied self-leveling floor underlayment.
   1. Use cementitious type at areas where existing tile was removed and depressions. As well as areas that require feathering for transitions to receive new floor finish. Ensure a straight and smooth floor finish as indicated on drawings. .

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2023.

B. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

C. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

D. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars; 2021.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.

C. Manufacturer's Instructions.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F (41 degrees C).

1.07 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F (10 degrees C) 24 hours before, during and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cementitious Underlayment:
   1. ARDEX Engineered Cements; ARDEX K 34 LIGHTWEIGHT with ARDEX P51 Primer: www.ardexamericas.com/#sle.
   2. H.B. Fuller Construction Products, Inc; TEC Level Set 200 Self-Leveling Underlayment with TEC Multipurpose Primer: www.tecspecialty.com/#sle.
   3. LATICRETE International, Inc; LATICRETE NXT LEVEL PLUS WITH NXT PRIMER: www.laticrete.com/#sle.

B. Primer:
   1. Mapei Corporation; Primer L: www.mapei.com/#sle.

2.02 MATERIALS

A. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
   1. Compressive Strength: Minimum 4000 pounds per square inch (27.6 MPa) after 28 days, tested per ASTM C109/C109M.
   2. Flexural Strength: Minimum 1000 psi (6.9 MPa) after 28 days, tested per ASTM C348.
   3. Density: 125 pounds per cubic foot (2002 kg/cu m), nominal.
   4. Final Set Time: 1-1/2 to 2 hours, maximum.
   5. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch (89 mm).
   6. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

B. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

C. Primer: Manufacturer's recommended type.

D. Joint and Crack Filler: Latex-based filler, as recommended by manufacturer.

2.03 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.02 PREPARATION

A. Concrete: Mechanically prepare steel troweled concrete to create a textured surface necessary to achieve the best bond; acceptable methods include bead blasting and scarifying. Do not use acid etching.

B. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

C. Vacuum clean surfaces.

D. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

E. Close floor openings.

3.03 APPLICATION

A. Install underlayment in accordance with manufacturer's instructions.

B. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft (1:1000).

C. For final thickness over 1-1/2 inches (38 mm), place underlayment in layers. Allow initial layer to harden to the point where the material has lost its evaporative moisture. Immediately prime and begin application of the subsequent layer within 24 hours.

D. Place before partition installation.

E. Where additional aggregate has been used in the mix, add a top layer of neat mix (without aggregate), if needed to level and smooth the surface.

F. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.04 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's instructions.

3.05 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION 035400

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SECTION 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Concealed wood blocking, nailers, and supports.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

B. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).

C. PS 20 - American Softwood Lumber Standard; 2021.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

B. General Purpose Construction Adhesives: Comply with ASTM C557.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Provide the following specific nonstructural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

3.04 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.05 CLEANING

A. Waste Disposal: See Section 017419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 061000

SECTION 064200
WOOD PANELING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Acoustic Slat Panel Wood Wall Panels as indicated in drawings

1.03 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 061000 - Rough Carpentry: Grounds and concealed blocking.

1.04 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

C. PS 20 - American Softwood Lumber Standard; 2021.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on fire-retardant treatment materials and application instructions.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide plan of panel number sequencing.

D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:
   1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   2. Provide designated labels on shop drawings as required by certification program.
   3. Provide designated labels on installed products as required by certification program.
   4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.07 MOCK-UP

A. Locate where directed.

B. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with applicable codes for fire-retardant requirements.

2.02 PANELING

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.

2.03 WOOD-BASED MATERIALS - GENERAL

2.04 ADHESIVES AND FASTENERS

A. Adhesives: Type suitable for intended purpose, complying with applicable air quality regulations.

B. Fasteners: Of size and type to suit application: conceled fastners

2.05 FABRICATION

A. Prepare panels for delivery to site, permitting passage through building openings.

B. Finish exposed edges of panels as specified by grade requirements.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting and scribing.

2.06 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

D. Wood Sealer: Factory-applied, water-based polymer, water-repellent sealer that reacts chemically with untreated, natural wood surfaces.
   1. Manufacturers:
      a. The Wood Veneer Hub or approved equal
      b. [Slatpanel; https://www.slatpanel.com/products/acoustic-slat-wood-panels].
      c. Muffle Timber, https://www.muffleacoustics.com/

2.07 ACCESSORIES

A. Wood Trim prime and sealed to match wood panel as indicated in drawings

B. Primer: Alkyd primer sealer type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify adequacy of backing and support framing.

C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Do not begin installation until wood materials have been fully acclimated to interior conditions.

C. Set and secure materials and components in place, plumb and level, using concealed fasteners wherever possible.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.8 mm).

END OF SECTION 064200

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SECTION 078100
APPLIED FIRE PROTECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Applied fire protection of interior structural steel not exposed to damage or moisture.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).

C. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).

D. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2023).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data indicating product characteristics.

C. Manufacturer's Certificate: Certify that applied fireproofing products meet or exceed requirements of Contract Documents.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience

1.07 FIELD CONDITIONS

A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F (4 degrees C) or when temperature is predicted to be below said temperature for 24 hours after application.

B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

C. Provide temporary enclosure to prevent spray from contaminating air.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.
   1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
   2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 APPLIED FIRE PROTECTION ASSEMBLIES

A. Provide assemblies as indicated on drawings.

2.02 MATERIALS

A. Applied Fire Protection Material for Interior Applications, Concealed: Manufacturer's standard factory mixed material, which when combined with water is capable of providing indicated fire resistance, and complying with following requirements:
   1. Bond Strength: 150 pounds per square foot (7.2 kPa), minimum, when tested in accordance with ASTM E736/E736M when set and dry.
   2. Dry Density: As required by fire resistance design.
   3. Compressive Strength: 8.33 pounds per square inch (57.4 kPa), minimum.
   4. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.
   5. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.
   6. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.

2.03 ACCESSORIES

A. Primer Adhesive: Of type recommended by applied fire protection manufacturer.

B. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive fireproofing.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.

D. Verify that voids and cracks in substrate have been filled.

E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.02 PREPARATION

A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.

B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.

C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.

D. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

E. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

A. Apply primer adhesive in accordance with manufacturer's instructions.

B. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 014000 - Quality Requirements.

B. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.

C. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).

D. Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.05 CLEANING

A. Remove excess material, overspray, droppings, and debris.

B. Remove fireproofing from materials and surfaces not required to be fireproofed.

END OF SECTION 078100

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SECTION 078400
FIRESTOPPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.03 RELATED REQUIREMENTS

A. Section 078100 - Applied Fire Protection.

B. Section 092116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.04 REFERENCE STANDARDS

A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

E. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.

F. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.

G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a.

H. ITS (DIR) - Directory of Listed Products; Current Edition.

I. FM 4991 - Approval Standard of Firestop Contractors; 2013.

J. FM (AG) - FM Approval Guide; Current Edition.

K. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

L. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

M. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

N. UL (DIR) - Online Certifications Directory; Current Edition.

O. UL (FRD) - Fire Resistance Directory; Current Edition.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.

E. Installer's qualification statement.

1.06 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

B. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
   2. Verification of minimum three years documented experience installing work of this type.
   3. Verification of at least five satisfactorily completed projects of comparable size and type.
   4. Licensed by local authorities having jurisdiction (AHJ).

1.07 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
   2. Hilti, Inc: www.hilti.com/#sle.
   3. Specified Technologies Inc: www.stifirestop.com/#sle.
   4. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: www.tremcosealants.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.

B. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

C. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

D. Acoustically Rated Firestopping: Provide system tested in accordance with ASTM E90 with STC rating of 53, minimum.

2.04 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

3.04 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 078400

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SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.03 RELATED REQUIREMENTS

A. Section 092116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.04 REFERENCE STANDARDS

A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

G. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

H. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Backing material recommended by sealant manufacturer.
   4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   5. Substrates the product should not be used on.

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

D. 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.

E. 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.

F. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
   1. Use ASTM C 1087 manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Submit not fewer than three pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
   5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

G. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
   1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
   2. Conduct field tests for each application indicated below:
      a. Each kind of sealant and joint substrate indicated.
   3. Notify Architect seven days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521. 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.
   5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
   6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

H. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

I. Executed warranty.

1.06 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. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. Adhesion Testing: In accordance with ASTM C794.
   2. Compatibility Testing: In accordance with ASTM C1087.
   3. Allow sufficient time for testing to avoid delaying the work.
   4. Deliver sufficient samples to manufacturer for testing.

5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

D. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
   1. Identification of testing agency.
   2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
      a. Test date.
      b. Copy of test method documents.
      c. Age of sealant upon date of testing.
      d. Test results, modeled after the sample form in the test method document.
      e. Indicate use of photographic record of test.

E. Field Adhesion Test Procedures:
   1. Allow sealants to fully cure as recommended by manufacturer before testing.
   2. Have a copy of the test method document available during tests.
   3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
   4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
   5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
   6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

F. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
   1. Sample: At least 18 inches (457 mm) long.
   2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch (25.4 mm) by that percentage; if adhesion failure occurs before the 1-inch mark is that distance from the substrate, the test has failed.
   3. If either adhesive or cohesive failure occurs before minimum elongation, take necessary measures to correct conditions and retest; record each modification to products or installation procedures.

G. Project Conditions
   1. Do not proceed with installation of joint sealants under the following conditions:
      a. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
      b. When joint substrates are wet.
      c. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
      d. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
      e.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5 year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not

cure. Complete forms in Owner's name and register with manufacturer.

C. Extended Correction Period: Correct defective work within 5 year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Interior Joints:
      a. Do not seal interior joints indicated on drawings as not sealed.
      b. Do not seal gaps and openings in gypsum board and suspended ceilings
      c. Do not seal through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
      d. Seal the following joints:
         1) Joints between door frames and window frames and adjacent construction.
         2) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, and piping penetrations.
         3) In sound-rated wall and ceiling assemblies, seal joints between wall assemblies and ceiling assemblies; between wall assemblies and other construction; between ceiling assemblies and other construction.
   2. Do Not Seal:
      a. Intentional weep holes in masonry.
      b. Joints indicated to be covered with expansion joint cover assemblies.
      c. Joints where sealant installation is specified in other sections.

B. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
   1. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.

C. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.02 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

B. Colors: As indicated on drawings.

2.03 NONSAG JOINT SEALANTS

A. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
   1. Color: White.

B. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Color: Match adjacent finished surfaces.
   3. Products:
      a. Sherwin-Williams Company; Stampede 2NS Polyurethane Sealant: www.sherwin-williams.com/#sle.
      b. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.
      c. Tremco Commercial Sealants & Waterproofing; Dymonic 100: www.tremcosealants.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

C. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
   1. Color: Standard colors matching finished surfaces, Type OP (opaque).
   2. Products:
      a. Hilti, Inc; Lightweight Smoke and Acoustic Sealant CS-S SA Light: www.us.hilti.com/#sle.
      b. Specified Technologies Inc; Smoke N' Sound Acoustical Sealant: www.stifirestop.com/#sle.
      c. Tremco Commercial Sealants & Waterproofing; Tremstop Smoke and Sound: www.tremcosealants.com/#sle.
      d. Accumetric LLC; BOSS 826 Acoustical Sound Sealant.
      e. Substitutions: See Section 016000 - Product Requirements.

2.04 ACCESSORIES

A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.

B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
   1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
   2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
   3. Record each test on Preinstallation Adhesion Test Log as indicated.
   4. If any sample fails, review products and installation procedures, consult manufacturer, or take other measures that are necessary to ensure adhesion; retest in a different location; if unable to obtain satisfactory adhesion, report to Architect.
   5. After completion of tests, remove remaining sample material and prepare joints for new sealant installation.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION 079200

SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Fire-rated hollow metal and frames.

C. Hollow metal borrowed lites glazing frames.

1.03 RELATED REQUIREMENTS

A. Section 087100 - Door Hardware.

B. Section 088000 - Glazing: Glass for doors and borrowed lites.

1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2022.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

H. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

I. ITS (DIR) - Directory of Listed Products; Current Edition.

J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

K. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

L. UL (DIR) - Online Certifications Directory; Current Edition.

M. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. Pioneer Industries
   4. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Typical Door Face Sheets: Flush.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
      a. Frame required to have steel, welded construction, with required reinforcing at corners and at hardware mounting locations. For doors over 48 inches wide, use minimum 14ga. Steel. Split-type or knock-down door frames are not acceptable.

D. Door Frames, Fire-Rated: Full profile/continuously welded type.
   1. Fire Rating: Same as door, labeled.
   2. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
      a. Frame required to have steel, welded construction, with required reinforcing at corners and at hardware mounting locations. For doors over 48 inches wide, use minimum 14ga. Steel. Split-type or knock-down door frames are not acceptable.
   3. Frame Finish: one (1) coat of shop primer and two (2) coats of Alkyd finish applied at the manufacturer’s recommended thickness. Use rust-inhibitvie primer for exterior doors. shop painting or field painting of hollow metal frames is acceptable. However, the bottom edge must be coated with specified finish.
   4. Glazing: Where glazing will be utilized in the door, use fixed integral stops on the exterior face, and emovable stops on the interior face. Provide wired glass for fire-rated doors. Comply with regulatory requirements limiting glass size in fire-rated doors

E. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch (0.4 mm) dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
   1. Fire-Rated Frames: Comply with fire rating requirements indicated.

2.06 ACCESSORIES

A. Glazing: As specified in Section 088000, factory installed.

B. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Install door hardware as specified in Section 087100.

D. Comply with glazing installation requirements of Section 088000.

E. Coordinate installation of electrical connections to electrical hardware items.

END OF SECTION 081113

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SECTION 081416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated.

1.03 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames.

B. Section 087100 - Door Hardware.

C. Section 088000 - Glazing.

1.04 REFERENCE STANDARDS

A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

B. ASTM E413 - Classification for Rating Sound Insulation; 2022.

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

D. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2022.

E. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

F. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Test Reports: Show compliance with specified requirements for the following:
   1. Sound-retardant doors and frames; sealed panel tests are not acceptable.

E. Manufacturer's qualification statement.

F. Warranty, executed in Owner's name.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
   1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Masonite Architectural; Aspiro Select Wood Veneer Doors: www.architectural.masonite.com/#sle.
   2. Buell Door Co.
   3. Ideal Wood Products
   4. Weyerhauser Co.

2.02 DOORS AND PANELS

A. Doors: See drawings for locations and additional requirements.
   1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with WDMA I.S. 1A.
      a. Use Heavy Duty unless otherwise indicated.
      b. Doors shall meet the standards of the Architectural Woodwork Institute, “Architectural Woodwork Quality Standards”, and “Architectural Flush Doors”, for grade of door, core construction, and finish.
      c. All interior wood doors shall be solid core with veneer finish as selected by Architect, rift cut, premium grade. Finish exposed edges of door with same species as door faces, with matching rain and cut. Provide book-matched veneer faces on door panels
      d. Where lites will be utilized in the doors, provide wood stops on each side of lite. Removable stops shall be used on the secured side of the door.

B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with WDMA I.S. 1A, Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. Manufacturers standard: in compliance with performance duty level indicated
      b. Stain and sheen: to
      c. System - 1, Lacquer, Nitrocellulose.
      d. Stain: Match Existing Door Slab finish.
      e. Sheen: Flat.

B. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:

2.07 ACCESSORIES

A. Hollow Metal Door Frames: See Section 081113.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.
   2. Install smoke and draft control doors in accordance with NFPA 105 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION 081416

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SECTION 087100
DOOR HARDWARE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Hardware for wood doors.

B. Hardware for fire-rated doors.

1.03 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames.

B. Section 081416 - Flush Wood Doors.

1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. BHMA (CPD) - Certified Products Directory; Current Edition.

C. BHMA A156.1 - Standard for Butts and Hinges; 2021.

D. BHMA A156.3 - Exit Devices; 2020.

E. BHMA A156.4 - Door Closers and Pivots; 2024.

F. BHMA A156.5 - Cylinders and Input Devices for Locks; 2020.

G. BHMA A156.6 - Standard for Architectural Door Trim; 2021.

H. BHMA A156.7 - Template Hinge Dimensions; 2016.

I. BHMA A156.13 - Mortise Locks & Latches Series 1000; 2022.

J. BHMA A156.16 - Standard for Auxiliary Hardware; 2023.

K. BHMA A156.18 - Standard for Materials and Finishes; 2020.

L. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems; 2023.

M. BHMA A156.31 - Electric Strikes and Frame Mounted Actuators; 2024.

N. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.

O. DHI (H&S) - Sequence and Format for the Hardware Schedule; 2019.

P. DHI (KSN) - Keying Systems and Nomenclature; 2019.

Q. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

R. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

T. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

V. UL (DIR) - Online Certifications Directory; Current Edition.

W. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
   1. Architect.
   2. Installer's Architectural Hardware Consultant (AHC).
   3. Hardware Installer.
   4. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting:
   1. Attendance Required:
      a. Contractor.
      b. Owner.
      c. Installer's Architectural Hardware Consultant (AHC).
   2. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Verify that keying and programming complies with project requirements.
      d. Establish keying submittal schedule and update requirements.
   3. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
      a. Access control requirements.
      b. Key control system requirements.
      c. Flow of traffic and extent of security required.
   4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
   5. Deliver established keying requirements to manufacturers.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
   3. List groups and suffixes in proper sequence.
   4. Provide complete description for each door listed.
   5. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   6. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
   2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
   3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.

E. Keying Schedule:
   1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

F. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Lock Cylinders: Ten for each master keyed group.

1.07 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
   1. Closers: Five years, minimum.
   2. Exit Devices: Three years, minimum.
   3. Locksets and Cylinders: Three years, minimum.
   4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.

3. Applicable provisions of NFPA 101.
4. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
5. Listed and certified compliant with specified standards by BHMA (CPD).

D. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule.

E. Fasteners:
1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
a. Aluminum fasteners are not permitted.
b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
2. Fire-Rated Applications: Comply with NFPA 80.
a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 BUTT HINGES

A. Manufacturers:
1. McKinney; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Hager Companies: www.hagerco.com/#sle.
3. Stanley, dormakaba Group: www.stanleyhardwarefordoors.com/#sle.

B. Hinges: Comply with BHMA A156.1, Grade 1.
1. Provide hinges on every swinging door.
2. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
3. Provide ball-bearing hinges at each door with closer.
4. Provide non-removable pins on interior outswinging doors at locations as indicated.
5. Provide following quantity of butt hinges for each door:
a. Doors From 60 inches (1.5 m) High up to 90 inches (2.3 m) High: Three hinges.

2.03 EXIT DEVICES

A. Manufacturers:
1. Von Duprin, an Allegion brand: www.allegion.com/us/#sle.
2. Sargent Manufacturing

B. Exit Devices: Comply with BHMA A156.3, Grade 1.
1. Lever design to match lockset trim.
2. Provide cylinder with cylinder dogging or locking trim.
3. Provide exit devices properly sized for door width and height.
4. Provide strike as recommended by manufacturer for application indicated.
5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.04 ELECTRIC STRIKES

A. Manufacturers:
1. Best (Vantage Lock), keypad or magnetic stripe function

B. Electric Strikes: Comply with BHMA A156.31, Grade 1.
1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.

2. Provide non-handed 24 VDC electric strike suitable for door frame material and scheduled lock configuration.

2.05 LOCK CYLINDERS

A. Manufacturers:
1. Best, dormakaba Group; 7A / 9A series: www.bestaccess.com/#sle.
2. Corbin/Russwin Architectural Hardware
3. Substitutions: Not permitted.

B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
1. Provide small format interchangeable core (SFIC) type cylinders, Grade 1, with seven-pin core in compliance with BHMA A156.5 at locations indicated.
2. Provide cylinders from same manufacturer as locking device.
3. Provide cams and/or tailpieces as required for locking devices.

2.06 MORTISE LOCKS

A. Manufacturers:
1. Corbin Russwin; an Assa Abloy Group company; 2000 series: www.assaabloydss.com/#sle.
2. Best, dormakaba Group; 7K: www.bestaccess.com/#sle.

B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
1. Latchbolt Throw: 3/4 inch (19 mm), minimum.
2. Deadbolt Throw: 1 inch (25.4 mm), minimum.
3. Backset: 2-3/4 inch (70 mm) unless otherwise indicated.
4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
a. Finish: To match lock or latch.

2.07 DOOR PULLS AND PUSH PLATES

A. Manufacturers:
1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Hager Companies: www.hagerco.com/#sle.
3. Hiawatha, Inc, division of Activar Construction Products Group, Inc: www.activarcpg.com/hiawatha/#sle.
4. Baldwin Hardware
5. Glynn-Johnson
6. Substitutions: Not permitted.

B. Door Pulls and Push Plates: Comply with BHMA A156.6.
1. Pull Type: Straight, unless otherwise indicated.
2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
a. Edges: Beveled, unless otherwise indicated.
3. Material: Aluminum, unless otherwise indicated.

2.08 DOOR PULLS AND PUSH BARS

A. Manufacturers:
1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Hager Companies: www.hagerco.com/#sle.
3. Hiawatha, Inc, division of Activar Construction Products Group, Inc: www.activarcpg.com/hiawatha/#sle.
4. Baldwin Hardware
5. Glynn-Johnson

6. Substitutions: Not permitted.

B. Door Pulls and Push Bars: Comply with BHMA A156.6.
   1. Bar Type: Bar set, unless otherwise indicated.
   2. Material: Aluminum, unless otherwise indicated.

2.09 CLOSERS

A. Manufacturers; Surface Mounted:
   1. Corbin Russwin or Norton; an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. LCN, an Allegion brand: www.allegion.com/us/#sle.
   3. Substitutions: Not permitted.

B. Closers: Comply with BHMA A156.4, Grade 1.
   1. Type: Surface mounted to door.
   2. Provide door closer on each exterior door.

2.10 KICK PLATES

A. Manufacturers:
   1. Hiawatha, Inc, an Activar Construction Products Group company: www.activarcpg.com/hiawatha/#sle.
   2. Baldwin Hardware
   3. Glynn-Johnson
   4. Hager
   5. Rockwood Architectural
   6. Ives

B. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
   1. Size: 8 inch (203 mm) high by 2 inch (51 mm) less door width (LDW) on push side of door.

2.11 FLOOR STOPS

A. Manufacturers:
   1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Hager Companies: www.hagerco.com/#sle.
   3. Hiawatha, Inc, division of Activar Construction Products Group, Inc: www.activarcpg.com/hiawatha/#sle.
   4. Baldwin Hardware
   5. Gylnn-Johnson
   6. Ives
   7.

B. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
   1. Provide floor stops when wall surface is not available; be cautious not to create a tripping hazard.
   2. Type: Manual hold-open, with pencil floor stop.
   3. Material: Aluminum housing with rubber insert.

2.12 WALL STOPS

A. Manufacturers:
   1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Hager Companies: www.hagerco.com/#sle.

3. Hiawatha, Inc, division of Activar Construction Products Group, Inc: www.activarcpg.com/hiawatha/#sle.
4. Baldwin Hardware
5. Ives

B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Provide wall stops to prevent damage to wall surface upon opening door.
2. Type: Bumper, concave, wall stop.
3. Material: Aluminum housing with rubber insert.

2.13 SILENCERS

A. Manufacturers:
1. Ives, an Allegion brand: www.allegion.com/us/#sle.
2. Rockwood; an Assa Abloy Group company: www.assaabloydss.com/#sle.
3. Baldwin Hardware
4. Glynn-Johnson
5. Hager
6. Rockwood Architectural

B. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
1. Single Door: Provide three on strike jamb of frame.
2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
3. Material: Rubber, gray color.

2.14 KEY CONTROL SYSTEMS

A. Key Control Systems: Comply with guidelines of BHMA A156.28.
1. Provide keying information in compliance with DHI (KSN) standards.
2. Keying: Grand master keyed.
3. Include construction keying and control keying with removable core cylinders.
4. Key to existing keying system.
5. Supply keys in quantities as required by owner.
a. 1 each Grand Master keys.
b. 6 each Construction Master keys.
c. 15 each Construction keys.
d. 2 each Construction Control keys.
e. 2 each Control keys if new system.

2.15 FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
1. Primary Finish: 625; bright chromium plated over nickel, with brass or bronze base material (former US equivalent US26); BHMA A156.18.
2. Secondary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

C. Use templates provided by hardware item manufacturer.

D. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list, unless noted otherwise on drawings.

E. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014000 - Quality Requirements.

3.03 ADJUSTING

A. Adjust work under provisions of Section 017000 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.04 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

3.05 PROTECTION

A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION 087100

SECTION 088000
GLAZING

PART 1 GENERAL

1.01 RELATED

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

1.02 SECTION INCLUDES

A. Glazing units, Interior Fire-rated.

B. Glazing compounds.

1.03 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

1.04 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

E. ASTM C1036 - Standard Specification for Flat Glass; 2021.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

J. GANA (GM) - GANA Glazing Manual; 2022.

K. GANA (SM) - GANA Sealant Manual; 2008.

L. GANA (LGRM) - Laminated Glazing Reference Manual; 2019.

M. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.

O. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

P. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.

Q. UL (DIR) - Online Certifications Directory; Current Edition.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data on Fire-Rated Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify

available colors.

D. Samples: Submit two samples 12" by 12" inch (12" by 12" mm) in size of glass units.

E. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods. Maintain one copy on site.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Laminated Glass Manufacturers:
   1. TGP - Fire rated , https://www.fireglass.com/resources/product-comparison/#Glass
   2. Euroverre, https://euroverre.com/en/glass-product/contraflam/

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   3. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
   1. In conjunction with weather barrier related materials described in other sections, as follows:

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
   3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.

4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.04 GLAZING UNITS

A. Type GL-1 - Monolithic Safety Glazing: fire-rated.
   1. Applications:
      a. Firelite Plus, 20-180 minutes fire-rated glazing by TGP is the basis of design.
      b. Glazed lites in doors, fire doors.
      c. Glazed sidelights to doors, in fire-rated walls and partitions.
      d. Other locations required by applicable federal, state, and local codes and regulations.
      e. Other locations indicated on drawings.
   2. Glass Type: Fire-rated, safety glass as specified.
   3. Tint: Clear.
   4. Thickness: 1/2" inch (12.5mm mm), nominal.

2.05 GLAZING COMPOUNDS

A. Type GC-4 - Polyurethane Sealant: Single component, chemical curing, nonstaining, nonbleeding; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 20 to 35; color as selected.

2.06 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.02 INSTALLATION, GENERAL

A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.03 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

3.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION 088000

SECTION 092116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Dvisions 01 Specifications Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Metal stud wall framing.

B. Acoustic insulation.

C. Gypsum sheathing.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.03 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 054000 - Cold-Formed Metal Framing: Structural steel stud framing.

C. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

D. Section 078400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

E. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.04 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

C. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

D. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

F. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).

G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.

J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

K. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

L. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

M. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

N. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2023.

O. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019, with Editorial Revision (2020).

P. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

Q. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

R. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

S. ASTM E413 - Classification for Rating Sound Insulation; 2022.

T. GA-216 - Application and Finishing of Gypsum Panel Products; 2021.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

D. Steel Framing Industry Association (SFIA) Certification:
   1. Submit documentation that metal studs and connectors used on project meet or exceed requirements of International Building Code.

E. SSMA Manufacturer Qualification: Submit documentation of manufacturer association membership.

F. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. SFIA Code Compliance Certification Program: www.CFSteel.org/#sle: Use metal studs and connectors certified for compliance with International Building Code.

B. Manufacturer Qualifications: Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

B. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
   1. Corrosion Protection Coating Designation: G40, or equivalent in accordance with AISI S220.

B. Manufacturers - Metal Framing, Connectors, and Accessories:

1. ClarkDietrich: www.clarkdietrich.com/#sle.
2. Jaimes Industries: www.jaimesind.com/#sle.
3. MarinoWARE: www.marinoware.com/#sle.
4. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

C. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
1. Studs: C-shaped with knurled or embossed faces.
2. Runners: U shaped, sized to match studs.

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company: www.americangypsum.com/#sle.
2. CertainTeed Corporation: www.certainteed.com/#sle.
3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
4. USG Corporation: www.usg.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Thickness:
   a. Vertical Surfaces: 5/8 inch (16 mm).
   b. Ceilings: 5/8 inch (16 mm).
3. Paper-Faced Products:
   a. American Gypsum Company; LightRoc Gypsum Wallboard: www.americangypsum.com/#sle.
   b. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.
   c. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
   d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
   e. USG Corporation; Sheetrock Brand Firecode X Panels 5/8 in. (15.9 mm): www.usg.com/#sle.
   f. USG Corporation; Sheetrock Brand UltraLight Panels Firecode ULIX 5/8 in. (15.9 mm): www.usg.com/#sle.
4. Mold-Resistant, Paper-Faced Products:

C. Abuse Resistant Wallboard:
1. Application: High-traffic areas indicated.
2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
6. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
7. Type: Fire-resistance-rated Type X, UL or WH listed.
8. Thickness: 5/8 inch (16 mm).
9. Edges: Tapered.
10. Paper-Faced Products:
    a. American Gypsum Company; M-Bloc AR Type X: www.americangypsum.com/#sle.

b. CertainTeed Corporation; Extreme Abuse Resistant Drywall with M2Tech: www.certainteed.com/#sle.
c. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold Guard Abuse-Resistant: www.gpgypsum.com/#sle.
d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Hi-Abuse Gypsum Board: www.goldbondbuilding.com/#sle.
e. USG Corporation; Sheetrock Brand Mold Tough AR Firecode X 5/8 in. (15.9 mm): www.usg.com/#sle.

2.03 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness as required for STC.

B. Acoustical Shielding: Recycled ethylene vinyl acetate (EVA) sheet membrane; applied between studs and gypsum board.
1. Sound Transmission Class (STC): Minimum of 53, calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
2. Fire Resistance: Where fire-resistance rating is specified for the wall in which the acoustical shielding membrane is mounted, provide assemblies that have been tested in accordance with ASTM E119 for the same rating as the wall.

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
1. Products:
a. Franklin International, Inc; Titebond Acoustical Smoke & Sound Sealant: www.titebond.com/#sle.
b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com/#sle.
c. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: www.stifirestop.com/#sle.

D. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Fiberglass Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
2. Joint Compound: Setting type, field-mixed.

F. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
1. Products:
a. CertainTeed Corporation; Level V Wall and Ceiling Primer/Surfacer with M2Tech: www.certainteed.com/#sle.
b. USG Corporation; USG Sheetrock Brand Tuff-Hide Primer-Surfacer: www.usg.com/#sle.

G. Abuse Resistant Finishes:
1. Acrylic, water-based, non-textured, high build, tintable primer and surfacer.

H. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

I. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

J. Adhesive for Attachment to Wood, ASTM C557 and Metal:
   1. Products:
      a. Franklin International, Inc; Titebond Drywall Construction Adhesive: www.titebond.com/#sle.
      b. Liquid Nails, a brand of PPG Architectural Coatings; ____: www.liquidnails.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C1007AISI S220 and manufacturer's instructions.

B. Studs: Space studs at 16 inches on center (at 406 mm on center).
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

D. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.

2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.08 PROTECTION

A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION 092116

SECTION 092253
SOUND BARRIER MULLION TRIM CAP - MULL-IT-OVER PRODUCTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Sound barrier mullion trim cap.

1.03 RELATED REQUIREMENTS

A. Section 092116 - Gypsum Board Assemblies.

1.04 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's data on partition to mullion connectors, showing details and accessories necessary to maintain fire rating of assembly.

C. Shop Drawings: Include cross-sections at locations where partitions terminate at perimeter construction, indicating dimensions and finish at each location. Indicate special details associated with fireproofing and acoustic seals.

D. Manufacturer's qualification statement.

E. Testing agency's qualification statement.

1.06 QUALITY ASSURANCE

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

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mull-It-Over Products, Inc; STC 55 Series: www.mullitoverproducts.com/#sle. or approved equal

B. Substitutions: permitted

2.02 MATERIALS

A. Sound Barrier Mullion Trim Cap: ASTM B221/ASTM B221M; extruded aluminum trim for maintaining sound barriers at intersections between gypsum board and glazing assemblies.
   1. Sound Transmission Class (STC): Rating of 55.

2. Trim Thickness: 0.125 inch (3 mm).
3. Gasket Thickness: 1/2 inch (12.7 mm).
4. Finish: Match glazing assembly framing finish.

2.03 ACCESSORIES

A. Compressible Foam: Between edge of extrusion and interior face of curtain wall.
1. Fire Resistance: ASTM E84, Class 1.
2. Fungi Resistance: Zero rating in accordance with ASTM G21.
3. Thickness: 1/2 inch (13 mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that gypsum board assemblies to which mullion trim caps are fastened are suitable for work of this section to commence.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Interface with Other Work: Comply with requirements of adjacent fire-resistance-rated construction; refer to drawings.

3.03 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean sound barrier mullion trim caps in accordance with manufacturer's instructions.

3.04 PROTECTION

A. Protect installed mullion trim caps from subsequent construction operations.

END OF SECTION 092253

SECTION 095100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.03 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

1.04 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two full size samples illustrating material and finish of acoustical units.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: 16 cases of each type and size.

1.06 QUALITY ASSURANCE

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
   2. Certainteed Architectural: www.certainteed.com/ceilings-and-walls/#sle.
   3. USG Corporation: www.usg.com/ceilings/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Suspension Systems:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
   2. USG Corporation: www.usg.com/ceilings/#sle.

3. Substitutions: Not permitted.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. VOC Content: As specified in Section 016116.

B. Acoustical Panels TYPE ACT-1: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type III.
      a. Form: 2, water felted.
   2. Size: 24 by 24 inches (610 by 610 mm).
   3. Thickness: 1 inch (25.4 mm).
   4. Ultima Square lay-in w/ 15/16" Grid
   5. NRC Range: .80 to .90, determined in accordance with ASTM E1264.
   6. Panel Edge: Square.
   7. Tile Edge: Beveled.
      a. Joint: Kerfed and rabbeted.
   8. Color: As indicated on drawings.
   9. Suspension System:
   10. 6" Cloud edge as indicated in drawings
   11. Shadow Molding (3/4" reveal) as indicated in drawings
   12. Products:
      a. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

B. Exposed Suspension System: Hot-dipped galvanized steel grid with steel cap.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 15/16 inch (24 mm) face width.
   3. Finish: Baked enamel.
   4. Color: White.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

B. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.

C. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

F. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

G. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean surfaces.

C. Replace damaged or abraded components.

END OF SECTION 095100

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SECTION 096813
TILE CARPETING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Carpet tile, fully adhered.

B. Removal of existing carpet tile.

1.03 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.04 REFERENCE STANDARDS

A. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Sustainable Design Submittal: Submit VOC content documentation for adhesives.

F. Installer's Qualification Statement.

G. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:
   1. Interface, Inc: www.interface.com/#sle.
   2. Mannington Commercial: www.manningtoncommercial.com#sle.
   3. Milliken & Company: www.milliken.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. Tile Carpeting, Type CPT-1,CPT-2,CPT3: Tufted, manufactured in one color dye lot.
   1. Product: Laylines, Milliken or approved equal, as indicated on drawings
   2. Tile Size: 19.7 x 19.7 inch (500 x 500 mm), nominal.
   3. Style/Color: As indicated on drawings
   4. Provide extra materials for maintenace as indicated in 1.05H

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

3.02 PREPARATION

A. Remove existing carpet tile.

B. Prepare floor substrates for installation of flooring in accordance with Section 090561.

C. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

D. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

E. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

F. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Trim carpet tile neatly at walls and around interruptions.

G. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Remove excess adhesive without damage, from floor, base, and wall surfaces.

C. Clean and vacuum carpet surfaces.

END OF SECTION 096813

SECTION 099123
INTERIOR PAINTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.03 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

E. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. MPI product number (e.g., MPI #47).
   3. Cross-reference to specified paint system products to be used in project; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 fc (860 lux) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Colors: As indicated on drawings.

2.02 PAINT SYSTEMS - INTERIOR

A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, aluminum, and acoustical ceilings.
   1. Two top coats and one coat primer.
   2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, 141, or 142.
   3. Primer: As recommended by top Coat manufacturer for specific substrate.

2.03 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
   4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Concrete:

F. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.

G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

H. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high-alkali surfaces.

I. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

J. Galvanized Surfaces:

K. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

L. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

M. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Sand wood and metal surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 099123

SECTION 101100
VISUAL DISPLAY BOARDS - ASI

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Porcelain enamel markerboards.

1.03 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood blocking and nailers.

1.04 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI A208.1 - American National Standard for Particleboard; 2022.

C. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

D. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's published data on porcelain enamel steel markerboard, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

D. Manufacturer's qualification statement

E. Maintenance Data: Include data on regular cleaning, stain removal[<>].

F.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Everwhite, https://everwhiteboards.com/whiteboard-resources/division-10/

B. Coronagroipinc.com

2.02 PORCELAIN ENAMEL MARKERBOARDS

A. : Markerboard Panel:

1. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, manufactured in accordance with Porcelain Enamel Institute's PEI-1002 specification consisting of sandwich-type construction of face panel with fired-on vitreous finish, core,

and balancing rear sheet.
2. Board Construction Type: Magnetic
3. Merge Framless Markerboardes
4. Face Sheet Writing Surface:
   a. Polyvision e3 CeramicSteel, ultra-smooth writing surface; scratch, stain, bacteria, and fire resistant. Continuous coil-coating process, consisting of steel core of light gauge covered on both sides with thin enamel coatings for thickness of 0.014 inch (0.356 mm).
   b. Color: White High Gloss.
5. Core Material:
   a. Particleboard: ANSI A208.1; wood set with waterproof resin binder, sanded faces.
   b. Thickness: 7/16-inch (11 mm) particleboard, laminated under heat and pressure to face panel and rear sheet, utilizing adhesives that ensure rupturing of component materials before failure of joint contact surfaces.
6. Writing Surface Backing:
   a. Polyvinyl backer moisture barrier; no adhesive required or recommended.
      1) Polyvinyl backer moisture barrier standard on all panels with exception to butt-joint (splined-edge markerboards) or horizontal sliders where galvanized back steel is used at minimum 28 gauge.
7. Panel Size:
   a. Overall Thickness: 1/2 inch (13 mm).
   b. Height: As indicated on drawings.
   c. Width: Custom as indicated in drawings.
8. Trim: As indicated below under Trim and Accessories.
9. Accessories: As indicated below under Trim and Accessories.

2.03 TRIM AND ACCESSORIES

A. Trim Series 9800 Knock Down (Multi-Panel/Combo Unit):
   1. Material: ASTM B221, extruded from aluminum alloy 6063-T5, 0.062-inch (1.57 mm) clear anodized finish, free from extruding draw marks and surface scratches.
   2. Exposed Frame Width: 3/8 inch (9.5 mm).
      a. Corner Style: Radius.
   3. Exposed Frame Width: 3/4 inch (19 mm).
      a. Corner Style: Square.

B. Accessories:
   1. Marker/Chalk Tray: ASI 544212, angle box style tray complete with end caps.
   2. Markers: Include.
   3. Marker Caddy: Include.
   4. Cloth: Include.
   5. Map Rail: ASI 51, 1-inch (25 mm) wide map rail with natural cork insert and end caps, and two map hooks per 4-foot (1219 mm) length.

C. Installation Method: Easi-Install L-clips.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and field dimensions meet manufacturer's requirements before starting work.

B. Verify field measurements are as indicated on drawings.

C. Verify internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Secure units level and plumb.

3.04 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean board surfaces in accordance with manufacturer's instructions.

3.05 PROTECTION

A. Cover with protective cover, taped to frame.

B. Protect finishes until completion of project.

C. Remove temporary protective cover at Date of Substantial Completion.

D. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 101100

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SECTION 102600
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Chair rails.

B. Corner guards.

1.03 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Blocking for wall and corner guard anchors.

1.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for metal crash rails. Complete forms in Owner's name and register with manufacturer.
   1. Failures include, but are not limited to, the following:
      a. Structural failures or internal connection failures.
      b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bumper Rails, Crash Rails, Protective Corridor Handrails, and Corner Guards:
   1. Construction Specialties, Inc; Acrovyn Solid Color and Chameleon Crash Rails: www.c-sgroup.com/#sle.
   2. Koroseal Interior Products: www.koroseal.com/#sle.

2.02 PRODUCT TYPES

A. Chair Rails: Factory- or shop-fabricated, with preformed end caps and internal and external corners:
   1. Performance of Installed Assembly:
      a. Support vertical live load of 100 lb/lineal ft (1,400 N/m) with deflection not to exceed 1/50 of span between supports.

b. Resist lateral force of 250 lbs (1112 N) at any point without damage or permanent set.

2. Material: Metal; as indicated in drawings.
3. Mounting: Surface.

B. Corner Guards - Surface Mounted:
1. Material: High impact vinyl.
2. Material: Polyethylene terephthalate (PET or PETG); PVC-free.
3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
4. Width of Wings: 2 inches (51 mm).
5. Corner: Square.
6. Color: as indicated in drawings
7. Length: One piece.

2.03 FABRICATION

A. Fabricate components with tight joints, corners and seams.

2.04 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

C. Verify that substrate surfaces for adhered items are clean and smooth.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position top of bumper rail 36 inches (914 mm) from finished floor.

C. Position corner guard 4 inches (102 mm) above finished floor to above wall base as indicated on drawings.

D. Terminate rails 1 inch (25.4 mm) short of door openings and intersecting walls.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch (6 mm).

3.04 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION 102600

SECTION 104300
EMERGENCY AID SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automated external defibrillators (AEDs).

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 099123 - Interior Painting: Field paint finish.

1.03 DEFINITIONS

A. Automated External Defibrillator (AED): A Food and Drug Administration (FDA)-approved portable device, which automatically analyzes the heart rhythm and recognizes the presence of ventricular fibrillation and/or tachycardia. If defibrillation is warranted, the AED automatically charges and prompts (visual and/or audio) the operator to deliver an electrical shock.

1.04 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide AED operational features, color and finish, anchorage details, and installation instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Automated External Defibrillators (AEDs):
   1. Philips Medical Systems: www.usa.philips.com/#sle.
   2. Stryker Corporation; HeartSine samaritan PAD 350P Defibrillator - PAD 350p: www.stryker.com/#sle.
   3. ZOLL Medical Corporation: www.zoll.com/#sle.

2.02 EMERGENCY AID CABINETS

A. Fire-Rated Cabinet Construction: One-hour fire rated.
   1. Steel; double wall with 5/8 inch (15.9 mm) thick fire barrier material.

B. Cabinet Configuration: Recessed type.

C. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with wire pull handle and nylon catch. Hinge door for 180 degree opening with two butt hinges.

D. Door Glazing: Tempered glass, clear, 1/8 inch (3 mm) thick, and set in resilient channel glazing gasket.

E. Finish of Cabinet Interior: White powder coat.

2.03 ACCESSORIES

A. Cabinet Door Signage: 'AED” decal, or vinyl self-adhering, prespaced black lettering and identifying graphic in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, from finished floor to inside bottom of cabinet.

C. Cabinet Lettering:
   1. Location: Face of door framing.

3.03 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust cabinet doors to operate smoothly without binding. Verify that alarms and integral locking devices operate properly.

C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes. Replace cabinets that cannot be restored to factory-finished appearance. Use materials and procedures recommended by cabinet manufacturer.

3.04 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for closeout submittals.

B. See Section 017900 - Demonstration and Training for additional requirements.

END OF SECTION 104300

SECTION 104400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 RELATED DOCUEMNTS

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

1.02 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.03 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 099123 - Interior Painting: Field paint finish.

1.04 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
   2. Ansul, a Tyco Business: www.ansul.com/#sle.
   3. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   4. Nystrom, Inc: www.nystrom.com/#sle.
   5. Potter-Roemer: www.potterroemer.com/#sle.

B. Fire Extinguisher Cabinets and Accessories:
   1. Activar Construction Products Group, Inc. - JL Industries; Ambassador Series: www.activarcpg.com/#sle.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   3. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
   4. Nystrom, Inc: www.nystrom.com/#sle.
   5. Potter-Roemer: www.potterroemer.com/#sle.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.

2. Finish: Baked polyester powder coat, color as selected.
3. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.
   1. Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.

B. Cabinet Configuration: Recessed type.
   1. Size to accommodate accessories.

2.04 ACCESSORIES

A. Lettering: “FIRE EXTINGUISHER” decal, or vinyl self-adhering, prespaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.03 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION 104400

SECTION 122400
WINDOW SHADES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Interior motorized roller shades.

B. Motor controls.

1.03 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.04 REFERENCE STANDARDS

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.

B. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
   2. Do not install shades until final surface finishes and painting are complete.

1.06 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
   1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.

B. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

C. Selection Samples: Include fabric samples in full range of available colors and patterns.
   1. Motorized Shades: Include finish selections for controls.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.09 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: One year.
   2. Electric Motors: One year.
   3. Electronic Control Equipment: One year.
   4. Fabric: One year.
   5. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Motorized Roller Shades, Motors and Motor Controls:
   1. Draper, Inc; Motorized FlexShade: www.draperinc.com/#sle.
   2. MechoShade Systems LLC; UrbanShade Double Roller - Motorized: www.mechoshade.com/#sle.
   3. SWFcontract, a division of Springs Window Fashions, LLC: www.swfcontract.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades Type RS-1 as indicated on drawings :
   1. Description - Interior Roller Shades: Double roller, motor operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
      a. Drop Position: Regular roll.
      b. Roll Direction: Roll down, closed position is at window sill.
      c. Mounting: Ceiling mounted.
      d. Size: As indicated on drawings.
      e. Fabric: As indicated under Shade Fabric article.
   2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
      a. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
   3. Roller Tubes: As required for type of shade operation.
      a. Material: Extruded aluminum, clear anodized finish.
      b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
      c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
   4. Hembars: Designed to maintain bottom of shade straight and flat.

a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.

5. Accessories:
   a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.
      1) Color: White.
      2) Profile: Square.
   b. End Caps: Provide manufacturer's standard end caps to cover exposed ends of brackets.
   c. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC

A. Fabric: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Manufacturers:
      a. Dual Roller Flexshade with Pocket Headbox c/w closure Panel
      b. Substitutions: See Section 016000 - Product Requirements.
   2. Material: Vinyl coated polyester.
   3. Performance Requirements:
      a. Flammability: Pass NFPA 701 large and small tests.
   4. Openness Factor: Double roll- Blackout and 1%.
   5. Color: White.

2.04 MOTOR CONTROLS

A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

B. Provide all components and connections necessary to interface with other systems as indicated.

C. Manual Controls:
   1. Control Functions:
      a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
      b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
      c. Raise: Raise controlled shade(s) only while button is pressed.
      d. Lower: Lower controlled shade(s) only while button is pressed.
      e. Presets: For selection of predetermined shade positions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

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

C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.05 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION 122400

SECTION 230516
EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. EJMA (STDS) - EJMA Standards; Tenth Edition.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Inner Hose: Bronze.

B. Exterior Sleeve: Single braided, stainless steel.

C. Pressure Rating: 350 psi up to 3 inch (2413.1 kPa up to 80 mm, DN).

D. Maximum Service Temperature: 250 degrees F (121 degrees C).

E. End Connections: Flanged.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Inner Hose: Bronze.

B. Exterior Sleeve: Braided bronze.

C. Pressure Rating: 250 psi up to 1-1/4 inch (1723.7 kPa up to 32 mm, DN).

D. End Connections: Welded or sweat.

E. Application: Copper piping.

2.03 EXPANSION JOINTS - STAINLESS STEEL BELLOWS TYPE

A. Pressure Rating: 200 psi and 250 degrees F (1380 kPa and 121 degrees C).

B. Maximum Compression: 1-3/4 inches (45 mm).

C. Maximum Extension: 1/4 inch (6 mm).

D. End Connections: Externally pressurized with threaded ends.

E. Application: Steel piping 3 inches (75 mm) and under.

2.04 EXPANSION JOINTS - EXTERNAL RING CONTROLLED STAINLESS STEEL BELLOWS TYPE

A. Pressure Rating: 200 psi and 250 degrees F (1380 kPa and 121 degrees C).

B. Maximum Compression: 15/16 inch (24 mm).

C. Maximum Extension: 5/16 inch (8 mm).

D. Maximum Offset: 1/8 inch (3 mm).

E. End Connections: Flanged.

F. Accessories: Internal flow liner and external shroud.

G. Application: Steel piping over 2 inches (50 mm).

2.05 EXPANSION JOINTS - COMPENSATORS

A. Type: Two-ply 304 stainless steel bellows with carbon steel shroud.

B. Maximum Working Pressure: 200 psi (1378.9 kPa).

C. Maximum Working Temperatures: 250 degrees F (121 degrees C).

D. End Connections: Female copper sweat.

E. Application: Copper piping up to 3 inches (75 mm, DN) in size or steel piping up to 4 inches (100 mm, DN) in size.

2.06 EXPANSION JOINTS - EXTERNALLY PRESSURIZED

A. Bellows Type: Two-ply, single bellows constructed of 304 stainless steel.

B. Internal Liner: Carbon steel with internal and external guides.

C. End Connections: Class 150, carbon steel, welded flange.

D. Maximum Axial Compression: 4 inch (102 mm).

E. Maximum Working Pressure: 150 psi (1030 kPa) at 700 degrees F (372 degrees C).

F. Application: Steel piping 2 inches (50 mm) and over.

2.07 ACCESSORIES

A. Pipe Alignment Guides:

1. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch (25 mm) thick insulation, minimum 3 inches (75 mm) travel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

G. Substitute grooved piping for vibration isolated equipment instead of flexible connectors. Grooved piping need not be anchored.

END OF SECTION 230516

SECTION 230517
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe-sleeve seals.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 230523 - General-Duty Valves for HVAC Piping.

C. Section 230553 - Identification for HVAC Piping and Equipment: Piping identification.

D. Section 230719 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch (25 mm) above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch (40 mm) angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1-1/2 inch (40 mm) angle ring or square set in silicone adhesive around penetration.

B. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

A. Modular Mechanical Sleeve-Seal:
   1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
   2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
   3. Size and select seal component materials in accordance with service requirements.
   4. Glass-reinforced plastic pressure end plates.

B. Sealing Compounds:
   1. Provide packing and sealing compound to fill pipe to sleeve thickness.
   2. Combined packing and seal compound is to match partition fire-resistance hourly rating.

C. Pipe Sleeve Material:
   1. Bearing Walls: Steel, cast iron, or terra-cotta pipe.
   2. Masonry Structures: Sheet metal or fiber.

D. Wall Sleeve: PVC material with waterstop collar, and nailer end-caps.

PART 3 EXECUTION

3.01 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

E. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer's recommendations.

F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

END OF SECTION 230517

SECTION 230523
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Angle valves.
B. Globe valves.
C. Ball valves.
D. Butterfly valves.
E. Check valves.

1.02 REFERENCE STANDARDS

A. API STD 594 - Check Valves: Flanged, Lug, Wafer, and Butt-Welding; 2022.
B. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
F. ASME B31.9 - Building Services Piping; 2020.
G. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).
H. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).
I. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
J. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
K. AWWA C606 - Grooved and Shouldered Joints; 2022.
L. MSS SP-45 - Drain and Bypass Connections; 2020.
M. MSS SP-67 - Butterfly Valves; 2022.
N. MSS SP-68 - High Pressure Butterfly Valves with Offset Design; 2021.
O. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.
P. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.
Q. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.
R. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends; 2011.
S. MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided; 2018.

1.03 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

B. Provide the following valves for the applications if not indicated on drawings:
   1. Throttling (Hydronic): Butterfly, Ball, Globe, and Angle.
   2. Isolation (Shutoff): Butterfly and Ball.

C. Heating Hot Water Valves:
   1. Size 2 inch (50 mm, DN) and Smaller, Brass and Bronze Valves:
      a. Threaded ends.
      b. Angle: Bronze disc, Class 125.
      c. Ball: Full port, one piece, brass trim.
      d. Swing Check: Bronze disc, Class 125.
      e. Globe: Bronze disc, Class 125.
   2. Size 2-1/2 inch (65 mm, DN) and Larger, Iron Valves:
      a. 2-1/2 inch (65 mm, DN) to 4 inch (100 mm, DN): Threaded ends.
      b. Ball: 2-1/2 inch (65 mm, DN) to 10 inch (250 mm, DN), Class 150.
      c. Single-Flange Butterfly: 2-1/2 inch (65 mm, DN) to 12 inch (300 mm, DN), aluminum-bronze disc, EPDM seat, 200 CWP.
      d. Grooved-End Butterfly: 2-1/2 inch (65 mm, DN) to 12 inch (300 mm, DN), 175 CWP.
      e. Butterfly: High performance, single flange, Class 150.
      f. Swing Check: Metal seats, Class 125.
      g. Swing Check: 2-1/2 inch (65 mm, DN) to 12 inch (300 mm, DN), lever and spring closure control, Class 125.
      h. Grooved-End Swing Check: 3 inch (80 mm, DN) to 12 inch (300 mm, DN), 300 CWP.
      i. Center-Guided Check: Compact-wafer, metal seat, Class 125.
      j. Plate-Type Check: Single plate, metal seat, Class 125 .
      k. Globe: 2-1/2 inch (65 mm, DN) to 12 inch (300 mm, DN), Class 125.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
   1. Handwheel: Valves other than quarter-turn types.
   2. Hand Lever: Quarter-turn valves 6 inch (150 mm, DN) and smaller.
   3. Wrench: Plug valves with square heads.
   4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

D. Valves in Insulated Piping: Provide 2 inch (50 mm, DN) stem extensions and the following features:
   1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
   2. Butterfly Valves: Extended neck.
   3. Memory Stops: Fully adjustable after insulation is installed.

E. Valve-End Connections:
   1. Threaded End Valves: ASME B1.20.1.
   2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
   3. Pipe Flanges and Flanged Fittings 1/2 inch (15 mm, DN) through 24 inch (600 mm, DN): ASME B16.5.
   4. Solder Joint Connections: ASME B16.18.
   5. Grooved End Connections: AWWA C606.

F. General ASME Compliance:
   1. Building Services Piping Valves: ASME B31.9.

G. Bronze Valves:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.03 BRONZE, ANGLE VALVES

A. CWP Rating: Class 125: 200 psi (1,380 kPa) and Class 150: 300 psi (2,070 kPa):
   1. Comply with MSS SP-80, Type 1.
   2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
   3. Ends: Threaded.
   4. Stem: Bronze.
   5. Disc: Bronze, PTFE, or TFE.
   6. Packing: Asbestos free.
   7. Handwheel: Bronze or aluminum.

2.04 BRONZE, GLOBE VALVES

A. CWP Rating: Class 125: 200 psi (1,380 kPa):
   1. Comply with MSS SP-80, Type 1.
   2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
   3. Ends: Threaded or solder joint.
   4. Stem and Disc: Bronze or PTFE.
   5. Packing: Asbestos free.
   6. Handwheel: Malleable iron.

2.05 IRON, GLOBE VALVES

A. CWP Ratings: Class 125: 200 psi (1,380 kPa) and Class 250: 500 psi (3,450 kPa):
   1. Comply with MSS SP-85, Type I.
   2. Body: Gray iron; ASTM A126, with bolted bonnet.
   3. Ends: Flanged.
   4. Trim: Bronze.
   5. Packing and Gasket: Asbestos free.
   6. Operator: Handwheel or chainwheel.

2.06 IRON, BALL VALVES

A. Split Body, Full Port:
   1. Comply with MSS SP-72.
   2. CWP Rating: 200 psi (1380 kPa).
   3. Body: ASTM A126, gray iron.
   4. Ends: Flanged.
   5. Seats: PTFE.
   6. Stem: Stainless steel.
   7. Ball: Stainless steel.

2.07 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Wafer Style:
   1. Comply with MSS SP-67, Type I.
   2. Wafer Style, CWP Ratings:
      a. Sizes 2 to 12 inch (50 to 300 mm, DN): 200 psi (1380 kPa).
      b. Sizes 14 to 24 inch (350 to 600 mm, DN): 150 psi (1034 kPa).

c. Vacuum Service: Down to 29.9 in-Hg (101.2 kPa).
3. Body Material: ASTM A126 cast iron or ASTM A536 ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: NBR.
6. Disc: Aluminum-bronze.

2.08 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psi (1200 kPa).
1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron.
3. Stem: Two-piece stainless steel.
4. Disc: Coated ductile iron.
5. Disc Seal: EPDM.

2.09 HIGH-PERFORMANCE, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type; Bidirectional dead end service without downstream flange:
1. Comply with MSS SP-68.
2. Class 150: CWP Rating: 285 psi (1,965 kPa) at 100 degrees F (38 degrees C).
3. Body: Provide carbon steel, cast iron, ductile Iron, or stainless steel.
4. Seat: Metal or reinforced PTFE.
5. Offset stem: Stainless steel.
6. Disc: Carbon steel.

2.10 BRONZE, SWING CHECK VALVES

A. Class 125:
1. Pressure and Temperature Rating: MSS SP-80, Type 3.
2. Design: Y-pattern, horizontal or vertical flow.
3. WSP Rating: 200 psi (1,380 kPa).
4. Body: Bronze, ASTM B62.
5. End Connections: Threaded or soldered.
6. Disc: Bronze.

2.11 IRON, FLANGED END SWING CHECK VALVES

A. Class 125:
1. 150 psi (1,035 kPa) with metal seats.
2. 200 psi (1,380 kPa) with metal seats and nonmetallic-to-metal seats.

2.12 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125:
1. Comply with MSS SP-71, Type I.
2. Body Design: Clear or full waterway.
3. Body Material: ASTM A126, gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Gasket: Asbestos free.
7. Closer Control: Factory installed, exterior lever, and spring or weight.

2.13 IRON, GROOVED-END SWING CHECK VALVES

A. Class 300:
1. CWP Rating: 300 psi (2,070 kPa).
2. Body Material: ASTM A536, Grade 65-45-12 ductile iron.
3. Seal: EPDM or Nitrile.

4. Disc: Ductile iron.
5. Coating: Black, non-lead paint.

2.14 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Globe:
1. Comply with MSS SP-125.
2. Body Material: ASTM A126, gray iron.
3. Style: Spring loaded.
4. Ends: Flanged.

B. Class 150, Compact-Wafer:
1. Comply with MSS SP-125.
2. Sizes 2-1/2 to 12 inch (65 to 300 mm, DN): CWP Rating; 300 psi (2,070 kPa).
3. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
4. Metal Seat: Bronze.

2.15 IRON, PLATE-TYPE CHECK VALVES

A. Class 125 Single-Plate:
1. Comply with API STD 594.
2. Body Design: Wafer, spring-loaded plate.
3. Body Material: ASTM A126, gray iron.
4. Resilient Seat: EPDM or NBR.

END OF SECTION 230523

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SECTION 230548
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings - Vibration Isolation Systems:
   1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.

1.03 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 15 years experience.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

D. Piping Isolation:
   1. Provide vibration isolators for piping supports:
      a. Located in equipment rooms.
      b. Located within 50 feet (15.2 m) of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
      c. For piping over 2 inch (50 mm) located below or within 50 feet (15.2 m) of noise-sensitive areas indicated.
   2. Minimum Static Deflection:
      a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch (50 mm) deflection required.
      b. Remainder of Supports: 0.75 inch (19 mm) deflection unless otherwise indicated.
   3. Suspended Piping, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
   4. Floor-Mounted Piping, Nonseismic Applications: Use open (unhoused) spring isolators.
   5. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

2.02 VIBRATION ISOLATORS

A. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
   a. Color code or otherwise identify springs to indicate load capacity.
   b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
   c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
   d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
   e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
   f. Selected to function without undue stress or overloading.

B. Vibration Isolators for Nonseismic Applications:
1. Resilient Material Isolator Pads:
   a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
   b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch (6 mm) thickness.
   c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
2. Resilient Material Isolator Mounts, Nonseismic:
   a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
3. Open (Unhoused) Spring Isolators:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
   b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
4. Housed Spring Isolators:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
   b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
   c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
   d. Furnished with integral leveling device for positioning and securing supported equipment.
5. Resilient Material Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
6. Spring Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.

b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

7. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.03 ACOUSTICAL AND VIBRATION ISOLATORS

A. General Requirements:
   1. Acoustical Isolation System: Through-stud isolators, pipe clamps, riser clamp pads, neoprene and felt lining material and associated support brackets.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:
   1. Spring Isolators:
      a. Position equipment at operating height; provide temporary blocking as required.
      b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
      c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
   2. Isolator Hangers:
      a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
      b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
   3. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
   4. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
   5. Adjust isolators to be free of isolation short circuits during normal operation.
   6. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

END OF SECTION 230548

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SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Stencils.

E. Pipe markers.

F. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Terminal Units: Tags.

B. Automatic Controls: Tags. Key to control schematic.

C. Dampers: Ceiling tacks, where located above lay-in ceiling.

D. Ductwork: Adhesive Backed Duct Markers.

E. Piping: Pipe markers.

F. Thermostats: Nameplates.

G. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Letter Color: White.

B. Letter Height: 1/4 inch (6 mm).

C. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
   2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.

3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.
4. Ductwork and Equipment: 2-1/2 inch (65 mm) high letters.

2.05 PIPE MARKERS

A. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch (20 mm) diameter color coded head.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 099123 for stencil painting.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 099123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Use tags on piping 3/4 inch (20 mm) diameter and smaller.
1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Install ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

H. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 230553

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

C. Commissioning activities.

1.02 RELATED REQUIREMENTS

A. Section 019113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B. Section 230800 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Duct systems are clean of debris.
   5. Fans are rotating correctly.
   6. Fire and volume dampers are in place and open.
   7. Access doors are closed and duct end caps are in place.
   8. Air outlets are installed and connected.
   9. Duct system leakage is minimized.
   10. Hydronic systems are flushed, filled, and vented.
   11. Proper strainer baskets are clean and in place.
   12. Service and balance valves are open.

3.03 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.04 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. Check and adjust systems approximately six months after final acceptance and submit report.

3.05 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

H. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

I. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

J. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

K. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.06 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

3.07 COMMISSIONING

A. See Sections 019113 - General Commissioning Requirements and 230800 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:
   1. Air side systems.
   2. Water side systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 10 percent of the air handlers plus a random sample equivalent to 10 percent of the final TAB report data as directed by Commissioning Authority.
   1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
   2. Use the same test instruments as used in the original TAB work.
   3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
   4. For purposes of re-check, failure is defined as follows:
      a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
      b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
      c. Temperatures: Deviation of more than one degree F (0.5 degree C).
      d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
      e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
   5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:
   1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.

2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.08 SCOPE

A. Test, adjust, and balance the following:
   1. Air Terminal Units.
   2. Air Inlets and Outlets.

3.09 MINIMUM DATA TO BE REPORTED

A. Terminal Unit Data:
   1. Manufacturer.
   2. Type, constant, variable, single, dual duct.
   3. Identification/number.
   4. Location.
   5. Model number.
   6. Size.
   7. Minimum static pressure.
   8. Minimum design air flow.
   9. Maximum design air flow.
   10. Maximum actual air flow.
   11. Inlet static pressure.

B. Air Distribution Tests:
   1. Air terminal number.
   2. Room number/location.
   3. Terminal type.
   4. Terminal size.
   5. Area factor.
   6. Design velocity.
   7. Design air flow.
   8. Test (final) velocity.
   9. Test (final) air flow.
   10. Percent of design air flow.

END OF SECTION 230593

SECTION 230713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Jacketing and accessories.

1.02 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.

F. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

G. ASTM C1775 - Standard Specification for Laminate Protective Jacket and Tape for Use Over Thermal Insulation for Outdoor Applications; 2022.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

K. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section, documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.05 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:

B. Insulation: ASTM C553; flexible, noncombustible blanket.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket.

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Secure with pressure-sensitive tape.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 180 degrees F (82 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.05 JACKETING AND ACCESSORIES

A. Canvas Jacket: UL listed 6 oz/sq yd (220 g/sq m) plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.

B. Aluminum Jacket:
   1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch (0.41 mm) with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   2. Thickness: 0.016 inch (0.40 mm) sheet.
   3. Finish: Smooth.
   4. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.

5. Fittings: 0.016 inch (0.40 mm) thick die-shaped fitting covers with factory-attached protective liner.
6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

C. Aluminum-Foil Laminate Jacket:
1. Factory-applied, pressure sensitive adhesive jacketing on paper release liner.
2. Finish: Aluminum smooth.
3. Comply with ASTM C1775.

D. Reinforced Tape:
1. FSK tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723 or ASTM E84.
3. Moisture Vapor Permeability: 0.00 perm inch (0.00 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.

2.06 DUCT LINER

A. Note: Choose the liner type - Elastomeric Foam, Glass Fiber, or Phenolic Foam.

B. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
2. Maximum Service Temperature: 180 degrees F (82 degrees C).
3. Fungal Resistance: No growth when tested according to ASTM G21.
4. Minimum Noise Reduction Coefficients:
   a. 1 inch (25 mm) Thickness: 0.40.
5. Connection: Waterproof vapor barrier adhesive.

C. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
1. Fungal Resistance: No growth when tested according to ASTM G21.
2. Minimum Noise Reduction Coefficients:
   a. 1 inch (25 mm) Thickness: 0.45.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

D. Insulated Ducts Conveying Air Above Ambient Temperature:
1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor) ((below 3 meters above finished floor)): Finish with canvas jacket sized for finish painting.

F. Duct Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.

2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

END OF SECTION 230713

SECTION 230719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

D. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.

E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

G. ASTM C1775 - Standard Specification for Laminate Protective Jacket and Tape for Use Over Thermal Insulation for Outdoor Applications; 2022.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section with documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturers:

B. Insulation: ASTM C553; flexible, noncombustible blanket.

C. Aluminum-Foil Laminate Jacket:
   1. Factory-applied, pressure sensitive adhesive jacketing to comply with ASTM C1775.

D. Vapor Barrier Jacket:
   1. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
   2. Secure with pressure-sensitive tape.

E. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film with pressure-sensitive rubber-based adhesive.

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum Service Temperature: 850 degrees F (454 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
   1. K (Ksi) Value: ASTM C177, 0.23 at 75 degrees F (0.034 at 24 degrees C).
   2. Maximum Service Temperature: 220 degrees F (104 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. Maximum Service Temperature: 650 degrees F (343 degrees C).
   2. Maximum Moisture Absorption: 0.2 percent by volume.

D. Aluminum-Foil Laminate Jacket:
   1. Factory-applied, pressure sensitive adhesive jacketing to comply with ASTM C1775.

E. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/(Pa s m)).

F. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.

G. Vapor Barrier Lap Adhesive: Compatible with insulation.

H. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.

2.04 CELLULAR GLASS

A. Pipe and Tubing Insulation: ASTM C552, Type II, Grade 6.
   1. K (Ksi) Value: 0.35 (0.050) at 100 degrees F (38 degrees C).

2. Service Temperature Range: From 250 degrees F (121 degrees C) to 800 degrees F (427 degrees C).
3. Water Vapor Permeability: 0.005 perm inch (0.007 ng/(Pa s m)) maximum per inch.
4. Water Absorption: 0.5 percent by volume, maximum.
5. Density: A minimum of 6.12 pcf (98 kg/cu m).

B. Block Insulation: ASTM C552, Type I, Grade 6.
1. K (Ksi) Value: 0.35 (0.050) at 100 degrees F (38 degrees C).
2. Service Temperature: 800 degrees F (427 degrees C), maximum.
3. Water Vapor Permeability: 0.005 perm inch (0.007 ng/(Pa s m)) maximum per inch.
4. Water Absorption: 0.5 percent by volume, maximum.

2.05 JACKETING AND ACCESSORIES

A. PVC Plastic.
1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: 0 degrees F (minus 18 degrees C).
b. Maximum Service Temperature: 150 degrees F (66 degrees C).
c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/(Pa s m)), maximum, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil, 0.010 inch (0.25 mm).
e. Connections: Brush on welding adhesive.
2. Covering Adhesive Mastic: Compatible with insulation.

B. Aluminum Jacket:
1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch (0.41 mm) with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.016 inch (0.40 mm) sheet.
3. Type: Factory-applied, self-adhesive jacketing.
4. Finish: Smooth.
5. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
6. Fittings: 0.016 inch (0.40 mm) thick die-shaped fitting covers with factory-attached protective liner.

C. Aluminum-Foil Laminate Jacket:
1. Factory-applied, pressure sensitive adhesive jacketing on paper release liner.
2. Finish: Aluminum smooth.
3. Comply with ASTM C1775.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

H. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
   1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

3.03 SCHEDULE

A. Heating Systems:
   1. Heating Water Supply and Return:

END OF SECTION 230719

SECTION 232113
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.
B. Heating water piping, above grade.
C. Equipment drains and overflows.
D. Pipe hangers and supports.
E. Unions, flanges, mechanical couplings, and dielectric connections.
F. Valves:
    1. Pressure independent temperature control valves and balancing valves.
G. Flow controls.

1.02 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels.
B. Section 230516 - Expansion Fittings and Loops for HVAC Piping.
C. Section 230523 - General-Duty Valves for HVAC Piping.
D. Section 230719 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. ANSI/FCI 70-2 - Control Valve Seat Leakage; 2021.
B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
C. ASME B16.15 - Cast Copper Alloy Threaded Fittings: Classes 125 and 250; 2018.
D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.
G. ASME B31.9 - Building Services Piping; 2020.
H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
J. ASTM B32 - Standard Specification for Solder Metal; 2020.
K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
L. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
M. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.
N. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).
O. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
Q. AWWA C606 - Grooved and Shouldered Joints; 2022.

R. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.04 QUALITY ASSURANCE

A. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in accessible locations only.
      a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
      b. Grooved mechanical connections and joints comply with AWWA C606.
      c. Use rigid joints unless otherwise indicated.
   4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:
   1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch (20 mm) gate valves with cap; pipe to nearest floor drain.
   2. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.
   3. In heating water systems, butterfly valves may be used interchangeably with gate and globe valves.
   4. For shut-off and to isolate parts of systems or vertical risers, use gate, ball, or butterfly valves.

2.02 HEATING WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
   2. Threaded Joints: ASME B16.3, malleable iron fittings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
      a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
      b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.

2.03 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:

1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2.04 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Greater: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
   5. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Adjustable steel yoke, cast iron roll, double hanger.
   6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.
   8. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
   9. Wall Support for Pipe Sizes 4 Inches (100 mm) and Greater: Welded steel bracket and wrought steel clamp.
   10. Vertical Support: Steel riser clamp.
   11. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   12. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   13. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   14. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.05 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe of 2 Inches (50 mm, DN) and Less:
   1. Ferrous Piping: 150 psi (1034 kPa) brass or malleable iron, threaded or sweat.
   2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches (50 mm, DN) and Greater:
   1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.
   2. Copper Piping: Bronze.
   3. Gaskets: 1/16 inch (1.6 mm) thick, preformed neoprene.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Mechanical Couplings: Comply with ASTM F1476.
   3. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.

4. When pipe is field grooved, provide coupling manufacturer's grooving tools.

2.06 PRESSURE INDEPENDENT TEMPERATURE CONTROL VALVES AND BALANCING VALVES

A. Control Valves: Factory-fabricated pressure independent with internal differential pressure regulator (DPRV), which automatically adjusts to normal changes in system pressure and provides 100 percent control valve authority at all positions of the valve.
   1. Maintain proportional and linear flow coil characteristics.
   2. PICV to accurately control the flow from 0 to 100 percent full rated flow with an operating pressure differential range of 3 to 60 psig (21 to 414 kPa).
   3. Provide ANSI/FCI 70-2 Class 4 shut-off on all sizes and field serviceable.
   4. Provide control valve to incorporate control, balancing, and flow limiting. Hydronic system pressure independent control valve bodies to comply with ASME B16.34 or ASME B16.15 pressure and temperature class ratings based on the design operating temperature and 150 percent of the system design operating pressure and have the following characteristics:
      a. 2 NPS (50 DN) and Smaller: Class 150 bronze or brass body with union connections, stainless steel trim, stainless steel rising stem, stainless steel disc or ball, and screwed ends with backseating capacity repackable under pressure.
      b. 2-1/2 NPS (65 DN) and Larger: Class 125 iron or ductile iron body, stainless steel trim, stainless steel rising stem, stainless steel disc or ball, flanged ends with backseating capacity repackable under pressure.
      c. Pressure Control Seat: Brass construction with vulcanized EPDM.
      d. Fittings and Components: All fittings and components to meet ANSI standards and be compatible with readily available components. 8-inch (200 mm) valves and above to be provided with proper companion flanges.
      e. Close-Off (Differential) Pressure Rating: Combination of actuator, DPRV action, and trim to provide a minimum close-off pressure rating of 150 percent of total system (pump) head. Provide actuator from the same manufacturer as the pressure independent control valve.

B. Electronic Actuators: Direct-mounted, self-calibrating type designed for minimum 60,000 full-stroke cycles at rated force.

C. Provide actuator with visible position indication. Fail positions on power failure to include in-place, open or closed as indicated in the controls specifications.
   1. Valves: Sized for maximum circuit flow rate and nominally, line-sized.
   2. Fail-Safe Operation: Mechanical, spring-return mechanism or capacitance return.
   3. Power Requirements (Modulating): Maximum 10 VA at 24 VAC or 8 watts at 24 VDC.
   4. Proportional Signal: 0 to 10 VDC or 2 to 10 VDC or 4 to 20 mA, and 2 to 10 VDC position feedback signal.

2.07 FLOW CONTROLS

A. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

B. Calibration: Control flow within 10 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 2 psi (13.7 kPa).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interference with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls, and floors.

F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

G. Slope piping and arrange to drain at low points.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 230516.

I. Inserts:
   1. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   2. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
   3. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

J. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
   2. Install hangers to provide minimum 1/2-inch (13 mm) space between finished covering and adjacent work.
   3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
   4. Use hangers with 1-1/2 inches (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping.
   8. Prime coat exposed steel hangers and supports. See Section 09 9123. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 230719.

L. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 083100 .

M. Install valves with stems upright or horizontal, not inverted.

3.02 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 Inch (15 mm) and 3/4 inch (20 mm): Maximum span, 5 feet (1500 mm); minimum rod size, 1/4 inch (6 mm).
   2. 1 Inch (25 mm): Maximum span, 6 feet (1800 mm); minimum rod size, 1/4 inch (6 mm).
   3. 1-1/2 Inches (40 mm) and 2 Inches (50 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
   4. 2-1/2 Inches (65 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).
   5. 3 Inches (80 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).

B. Hanger Spacing for Steel Piping.
   1. 1/2 Inch (15 mm), 3/4 Inch (20 mm), and 1 Inch (25 mm): Maximum span, 7 feet (2100 mm); minimum rod size, 1/4 inch (6 mm).

2. 1-1/4 Inches (32 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
3. 1-1/2 Inches (40 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).
4. 2 Inches (50 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).
5. 2-1/2 Inches (65 mm): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (9 mm).
6. 3 Inches (80 mm): Maximum span, 12 feet (3.6 m); minimum rod size, 3/8 inch (9 mm).
7. 4 Inches (100 mm): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).
8. 6 Inches (150 mm): Maximum span, 17 feet (5.1 m); minimum rod size, 1/2 inch (13 mm).

END OF SECTION 232113

SECTION 233100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 099113 - Exterior Painting: Weld priming, weather resistant, paint or coating.

C. Section 099123 - Interior Painting: Weld priming, paint or coating.

D. Section 230713 - Duct Insulation: External insulation and duct liner.

E. Section 233300 - Air Duct Accessories.

F. Section 233319 - Duct Silencers.

G. Section 233600 - Air Terminal Units.

H. Section 233700 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

F. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).

G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

H. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

J. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

L. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 233319.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range:
   1. Round: Plus or minus 2 in-wc (500 Pa) of galvanized steel.
   2. Rectangular: Plus or minus 1/2 in-wc (125 Pa) of galvanized steel.

E. Duct Sealing and Leakage in accordance with Static Pressure Class:
   1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
      a. Supply Air: 1/2 in-wc (125 Pa) pressure class, galvanized steel.
      b. Return and Relief Air: 1/2 in-wc (125 Pa) pressure class, galvanized steel.
      c. General Exhaust Air: 1/2 in-wc (125 Pa) pressure class, galvanized steel.
   2. Low Pressure Service: Up to 2 in-wc (500 Pa):
      a. Seal: Class C, apply to seal off transverse joints.
      b. Leakage:
         1) Rectangular: Class 24 or 24 cfm/100 sq ft (680 Lpm/9.3 sq m).
         2) Round: Class 12 or 12 cfm/100 sq ft (340 Lpm/9.3 sq m).
   3. Low Pressure Service: From 2 in-wc (500 Pa) to 3 in-wc (750 Pa):
      a. Seal: Class B, apply sealing of transverse joints and longitudinal seams.
      b. Leakage:
         1) Rectangular: Class 12 or 12 cfm/100 sq ft (340 Lpm/9.3 sq m).
         2) Round: Class 6 or 6 cfm/100 sq ft (170 Lpm/9.3 sq m).

F. Duct Fabrication Requirements:
   1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
   2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
   3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
   4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
   5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
   6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
   7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.02 METAL DUCTS

A. Material Requirements:

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
2. Aluminum: ASTM B209/B209M, aluminum sheet, alloy 3003-H14.

B. Rectangular Metal Duct:
1. Rectangular Double Wall Insulated: Rectangular spiral lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with the solid inner wall.
a. Insulation:
1) Thickness: 1 inch (25 mm).
2) Material: Fiberglass.

C. Round Metal Ducts:
1. Round Double Wall Insulated Duct: Round spiral lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with the solid inner wall.
a. Insulation:
1) Thickness: 1 inch (25 mm).
2) Material: Air.
2. Round Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).

D. Round Spiral Duct:
1. Round spiral lock seam duct with galvanized steel outer wall.

E. Connectors, Fittings, Sealants, and Miscellaneous:
1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
b. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
4. Gasket Tape:
a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
5. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
6. Hanger Fasteners: Attach hangers to structure using appropriate fasteners as follows:
a. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
b. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
c. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
d. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
e. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
f. Other Types: As required.

2.03 FLEXIBLE DUCTS

A. Flexible Ducts: UL 181, Class 1, polyethylene film, mechanically fastened and rolled using galvanized steel to form spiral helix.
1. Pressure Rating: 10 in-wc (2.50 kPa) positive and 5 in-wc (1.25 kPa) negative.
2. Maximum Velocity: 5500 fpm (27.9 m/sec).

3. Temperature Range: Minus 20 degrees F to 250 degrees F (Minus 28 degrees C to 121 degrees C).

B. Acoustic Flexible Ducts: UL 181, Class 1, spunbond nylon, mechanically fastened and rolled using galvanized steel to form spiral helix.
   1. Inner Core: Spunbonded, nonwoven inner core.
   2. Pressure Rating: 6 in-wc (1.5 kPa) positive and 5 in-wc (1.25 kPa) negative.
   3. Maximum Velocity: 4000 fpm (20.3 m/sec).
   4. Temperature Range: Minus 20 degrees F to 250 degrees F (Minus 28 degrees C to 121 degrees C).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. Comply with safety standards NFPA 90A and NFPA 90B.

D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

G. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Connect terminal units to supply ducts directly or with one foot (300 mm) maximum length of flexible duct. Do not use flexible duct to change direction.

J. Connect diffusers or light troffer boots to low-pressure ducts directly or with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

K. Fire Partitions: Provide firestopping sealing. See Section 078400.

L. Duct Accessories, Terminal Units, Inlets, and Outlets: Interconnect as indicated in Sections 233300, 233600, and 233700.

M. Duct Insulation: Provide duct insulation. See Section 230713.

N. Painting: Provide surface finish as indicated on drawings. See Sections 099113 and 099123.

END OF SECTION 233100

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.
B. Backdraft dampers - metal.
C. Backdraft dampers - fabric.
D. Combination fire and smoke dampers.
E. Duct access doors.
F. Duct test holes.
G. Fire dampers.
H. Flexible duct connectors.
I. Smoke dampers.
J. Volume control dampers.
K. Low leakage (Class 1A) control dampers.

1.02 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.
B. Section 233100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
B. NFPA 92 - Standard for Smoke Control Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
D. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
E. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
F. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

2.02 BACKDRAFT DAMPERS - METAL

A. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Extruded aluminum, with center pivoted blades of maximum 6 inch (150 mm) width, with felt or flexible vinyl sealed

edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 BACKDRAFT DAMPERS - FABRIC

A. Fabric Backdraft Dampers: Factory-fabricated.
   1. Blades: Neoprene coated fabric material.
   2. Birdscreen: 1/2 inch (12 mm) nominal mesh of galvanized steel or aluminum.
   3. Maximum Velocity: 1000 fpm (5 mps) face velocity.

2.04 COMBINATION FIRE AND SMOKE DAMPERS

2.05 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.06 DUCT TEST HOLES

A. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.07 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Horizontal Dampers: Galvanized steel, 22-gauge, 0.0299-inch (0.76 mm) frame, stainless steel closure spring, and lightweight, heat-retardant, non-asbestos fabric blanket.

C. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1-inch (250 Pa) pressure-class ducts up to 12 inches (300 mm) in height.

D. Multiple Blade Dampers: 16-gauge, 0.0598-inch (1.52 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 by 1/2 inch (3.2 by 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

E. Fusible Links: UL 33, separate at 160 degrees F (71 degrees C) with adjustable link straps for combination fire/balancing dampers.

2.08 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

C. Maximum Installed Length: 14 inch (356 mm).

2.09 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

B. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by pneumatic actuator.

C. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

2.10 VOLUME CONTROL DAMPERS

A. Splitter Dampers:
   1. Material: Same gauge as duct to 24 inches (600 mm) size in either direction, and two gauges heavier for sizes over 24 inches (600 mm).
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.

3. Operator: Minimum 1/4 inch (6 mm) diameter rod in self aligning, universal joint action, flanged bushing with set screw.

B. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch (150 by 760 mm).
   2. Blade: 24 gauge, 0.0239 inch (0.61 mm), minimum.

C. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches (200 by 1825 mm). Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.

2.11 LOW LEAKAGE (CLASS 1A) CONTROL DAMPERS

A. Frame:
   1. Material: 20-gauge galvanized steel.

B. Blade:
   1. Type: Multi-blade extruded airfoil for high pressure.
   2. Operation: As indicated on drawings.
      a. Parallel type: for modulating and mixing applications
      b. Opposed type: for open/shut applications
   3. Maximum Individual Blade Height: 8 inches (203 mm).
   4. Material: 12-gauge aluminum.

C. Insulation: Water-resistant sound absorbing material.

D. Other Requirements:
   1. Rust Inhibitor Coating: Moisture and salt water-resistant.
   2. Sleeve or Flange: Factory-mounted standard.
   3. Custom: Include bird screen.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch (200 by 200 mm) size access door for hand and shoulder access, or as indicated on drawings. Provide minimum 4 by 4 inch (100 by 100 mm) size access door for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire-rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

G. Demonstrate re-setting of fire dampers to Owner's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

1. See Section 230548.

J. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

K. Use splitter dampers only where indicated.

L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 233300

SECTION 233600
AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-duct terminal units.
   1. Variable-volume units.
B. Fan-powered units.
C. Controls for terminal units.

1.02 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.
B. Section 233100 - HVAC Ducts and Casings.
C. Section 251400 - Integrated Automation Local Control Units: HVAC controllers.
D. Section 251500 - Integrated Automation Software: BAS or BMS.
E. Section 253513 - Integrated Automation Actuators and Operators: Actuators.
F. Section 253519 - Integrated Automation Control Valves.

1.03 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).
B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).
C. ASHRAE RP-1455 - Seminar 65 - Standardized Best of Class Sequences for HVAC Systems; 2016.
D. ASHRAE Std 130 - Laboratory Methods of Testing Air Terminal Units; 2016.
E. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2019).
F. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.
G. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.
H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
J. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate airflow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
   1. Include schedules listing discharge and radiated sound power level for each of the second through sixth-octave bands at inlet static pressures of 1 to 4 in-wc (250 to 1000 Pa).
D. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME UNITS

A. Manufacturers:
1. Titus
2. Carrier
3. Price Industries, Inc
4. Trane Technologies
5. Approved equal

B. Basis of Design: Price Industries, Inc: www.priceindustries.com/#sle.
1. Single-Duct Terminal Unit: SDV, (direct digital controls).
2. Quiet Controller, Single-Duct Terminal Unit: SDVQ, (direct digital controls).

C. General:
1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

D. Unit Casing:
1. Minimum 22 gauge, 0.0299 inch (0.76 mm) galvanized steel.
2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, with slip-and-drive connections.
4. Acceptable Liners:
   a. 1 inch (25 mm) thick, coated, fibrous-glass complying with ASTM C1071.
      1) Secure with adhesive.
      2) Coat edges exposed to airstream with NFPA 90A approved sealant.
      3) Cover liner with non-porous foil.
   b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

E. Sound Attenuator:
1. Provide complete with sound attenuator
2. Construction to consist of a continuous extension of the casing and liner as required to achieve required attenuation.
3. At 2000 fpm (10.16 m/s) inlet velocity, the minimum operating pressure with attenuator added not to exceed 0.14 in-wc (34.84 Pa).

F. Damper Assembly:
1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.

2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak damper blades for tight airflow shutoff.
    a. Air Leakage Past Closed Damper: Maximum two percent of unit maximum airflow at 3 in-wc (750 Pa) inlet static pressure, tested in accordance with ASHRAE Std 130.

G. Hot Water Heating Coil:
1. Coil Casing: Minimum 22 gauge, 0.0299 inch (0.76 mm) galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
    a. Access Door: Gasketed and insulated located downstream of coils.
2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
3. Coil leak tested to minimum 350 psig (2413 kPa).
4. Base performance data on tests run in accordance with AHRI 410 and units to bear AHRI 410 label.

H. Electrical Requirements:
1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

I. Control Transformers: Factory supplied and mounted for electric and electronic control applications.

J. Controls:
1. Terminal Unit Controls:
    a. Provide accessories for field interfaced controller including ball valve and thermostat.
    b. Factory ship DDC controller including airflow sensor, integral airflow transmitter, integral damper actuator, and duct-mounted temperature sensor.
    c. Sequence of Operation: Zone temperature control with airflow and coil discharge monitoring.
2. DDC (Direct-Digital Controls):
    a. Include a factory-installed, unit-mounted, direct-digital controller.
    b. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
    c. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFMs.
        1) Occupied and unoccupied operating mode.
        2) Remote reset of temperature or CFM set points.
        3) Proportional, plus integral control of room temperature.
        4) Monitoring and adjusting with portable terminal.
    d. Room Sensor:
        1) Compatible with temperature controls specified.
        2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.
    e. See Section 25 1400.
3. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
    a. Signal accuracy: Plus/minus five percent throughout terminal operating range.

2.02 FAN-POWERED SERIES UNITS

A. Manufacturers:
1. Titus
2. Carrier
3. Price Industries, Inc

4. Trane Technologies
5. Approved equal

B. Basis of Design: Price Industries, Inc: www.priceindustries.com/#sle.
   1. Variable-Volume Parallel Fan-Powered Unit: FDV, (direct digital controls).
   2. Constant-Volume, Acoustically Enhanced Series Fan-Powered Unit: FDCA2, (direct digital controls).
   3. Low Profile, Variable-Volume Parallel Fan-Powered Unit: FDVLP, (direct digital controls).

C. General:
   1. Factory-assembled and wired, AHRI 880 (I-P) rated, horizontal fan-powered terminal unit with blower, blower motor, mixing plenum, and primary air damper contained in a single unit housing.

D. Unit Casing:
   1. Minimum 22 gauge, 0.0299 inch (0.76 mm) galvanized steel.
   2. Primary Air Inlet Collar: Suitable for standard flexible duct sizes.
   3. Unit Discharge: Rectangular, suitable for flanged duct connection.
   4. Plenum Inlet: Filter rack with disposable filters.
      a. 1 inch (25 mm) thick disposable fiberglass filters.
   5. Acceptable Liners:
      a. 1/2 inch (13 mm) thick, coated, fibrous-glass complying with ASTM C1071.
         1) Secure with adhesive.
         2) Coat edges exposed to airstream with NFPA 90A approved sealant.
         3) Cover liner with non-porous foil.

E. Sound Attenuator:
   1. Provide complete with sounds attenuator.
   2. Construction to consist of a continuous extension of the casing and liner as required to achieve required attenuation.

F. Primary Air Damper Assembly:
   1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid shaft rotating in bearings.
   2. Provide indicator on damper shaft or alternative method for indicating damper position over full range of 90 degrees.
   3. Incorporate low leak (2 percent) damper blades for tight airflow shutoff.
   4. Fan(s): Forward curved, centrifugal type.
   5. Fan Motor:
      a. ECM (Electrically Commutated Motor):
         1) Brushless DC controlled by an integrated controller/inverter that operates the wound stator and senses rotor position to electrically commutate the stator.
         2) Permanent magnet type motor with near-zero rotor losses designed for synchronous rotation.
         3) Designed to maintain 70 percent efficiency over the entire operating range.
      b. Fan motor shaft directly connected to fan and isolated from unit casing to prevent transmission of vibration.

G. Hot Water Heating Coil:
   1. Coil Casing: Minimum 22 gauge, 0.0299 inch (0.76 mm) galvanized steel, factory-installed on terminal unit with flanged discharge for attachment to downstream ductwork.
   2. Heavy-gauge aluminum fins, mechanically bonded to tubes.
   3. Copper Tubes: 0.016 inch (0.406 mm) minimum wall thickness with male solder header connections.

4. Coil leak tested to minimum 305 psig (2413 kPa).
5. Base performance data on tests run in accordance with AHRI 410.

H. Electrical Requirements:
1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

I. Controls:
1. Terminal Unit Controls:
a. Provide accessories for field interfaced controller including globe valve and fan controlling thermostat.
b. Factory ship pneumatic controller including integral airflow transmitter, integral damper actuator, and duct-mounted temperature sensor.
c. Sequence of Operation: Zone air temperature control with coil discharge monitoring.
2. DDC (Direct-Digital Controls):
a. Include a factory-installed, unit-mounted, direct-digital controller.
b. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
c. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFMs.
1) Occupied and unoccupied operating mode.
2) Remote reset of temperature or CFM set points.
3) Proportional, plus integral control of room temperature.
4) Monitoring and adjusting with portable terminal.
d. Room Sensor:
1) Compatible with temperature controls specified.
2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.
3. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
a. Signal accuracy: Plus/minus five percent throughout terminal operating range.

2.03 CONTROLS FOR TERMINAL UNITS

A. Direct or Distributed Digital Controller (DDC), Integrated:
1. Provide application specific controller, see Section 251400 and 251500.
2. Accuracy: Plus/minus five percent of analog input readings and analog outputs.
3. Sequence of Operation: Follow ASHRAE RP-1455 for specific terminal unit.
4. Zone Thermostat:
a. Temperature-CO2 combination device.
b. Show values and setpoint on numeric display in celsius and fahrenheit units.
c. Wall-mounted with occupancy sensor, setpoint adjust, and service port.
5. Damper Actuator:
a. Direct-mounted, modulating, fail last actuator, see Section 253513.
6. Reheat Coil:
a. 2-way, modulating, fail open ball valve, see Section 253519.
b. Feedback: Position potentimeter and open/closed status switches.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. See drawings for the size(s) and duct location(s) of the air terminal units.

D. Provide ceiling access doors or locate units above easily removable ceiling components.

E. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.

F. Do not support from ductwork.

G. Connect to ductwork in accordance with Section 233100.

H. Provide minimum of 5 ft (1.5 m) of 1 inch (25 mm) thick lined ductwork downstream of units.

I. Verify that electric power is available and of the correct characteristics.

3.02 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for closeout submittals.

B. See Section 017900 - Demonstration and Training for additional requirements.

END OF SECTION 233600

SECTION 233700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers:

B. Rectangular ceiling diffusers.

C. Registers/grilles:
   1. Ceiling-mounted, egg crate exhaust and return register/grilles.
   2. Ceiling-mounted, exhaust and return register/grilles.
   3. Ceiling-mounted, supply register/grilles.
   4. Wall-mounted, supply register/grilles.
   5. Wall-mounted, exhaust and return register/grilles.

1.02 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.04 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of experience.

PART 2 PRODUCTS

2.01 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square formed adjustable, backpan stamped, core removable, and multi-louvered ceiling diffusers constructed to maintain 360 degree discharge air pattern with sectorizing baffles where indicated.

B. Connections: Round.

C. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Steel with baked enamel finish.

E. Color: As selected by Architect from manufacturer's standard range.

F. Accessories: Provide radial opposed blade, butterfly, and combination splitter volume control damper; removable core, sectorizing baffle, safety chain, wire guard, equalizing grid, operating rod extension, anti-smudging device, and gaskets for surface mounted diffusers with damper adjustable from diffuser face.

2.02 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.

B. Frame: 1-1/4 inch (32 mm) margin with concealed mounting and gasket.

C. Construction: Made of aluminum extrusions with factory enamel finish.

D. Color: As selected by Architect from manufacturer's standard range.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.03 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with blades set at 45 degrees, horizontal face.

B. Frame: 1-1/4 inch (32 mm) margin with concealed mounting.

C. Fabrication: Steel with 20 gauge, 0.0359 inch (0.91 mm) minimum frames and 22 gauge, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gauge, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: To be selected by Architect from manufacturer's standard range.

2.04 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch (13 by 13 by 13 mm) grid core.

B. Fabrication: Grid core consists of aluminum with mill aluminum finish.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Frame: 1-1/4 inch (32 mm) margin with concealed mounting.

E. Frame: Channel lay-in frame for suspended grid ceilings.

F. Accessories: Provide integral gang and face operated opposed blade damper, plaster frame, prescored molded fiberglass back, and 45 degree angled eggcrate or other similar provisions for visual blocking such as angled louver or 90 degree duct elbow.

2.05 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing with spring or other device to set blades, horizontal face, double deflection.

B. Fabrication: Steel with 20 gauge, 0.0359 inch (0.91 mm) minimum frames and 22 gauge, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gauge, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.06 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with spring or other device to set blades, horizontal face.

B. Frame: 1-1/4 inch (32 mm) margin with concealed mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: To be selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

END OF SECTION 233700

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SECTION 250500
COMMON WORK RESULTS FOR INTEGRATED AUTOMATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Common work results for integrated automation.

1.02 RELATED REQUIREMENTS

A. Conform to Wayne State University "**Cohn Nursing Renovation - Building Automation System (BAS) Standard**" appended to the specifications.

B. Section 230553 - Identification for HVAC Piping and Equipment.

C. Section 230593 - Testing, Adjusting, and Balancing for HVAC.

D. Section 251400 - Integrated Automation Local Control Units.

E. Section 253500 - Integrated Automation Instrumentation and Terminal Devices for HVAC.

F. Section 253519 - Integrated Automation Control Valves.

G. Section 260553 - Identification for Electrical Systems.

1.03 DEFINITIONS

A. Cloud: Virtual private or rented server data hosting service.

B. FDD: Fault detection and diagnostics.

C. ECM: Energy conservation measure.

D. GUI: Graphical user interface.

E. HMI: Human machine interface or operator interface.

F. I-O: Input and output objects or points or field-interfaced devices.

G. IT: Information Technology or Computer-Network Agent.

H. OEM: Original equipment manufacturer or factory-provided.

I. O&M: Operations and maintenance.

J. Peer-to-Peer: Resource linking and sharing between two or more devices.

K. Point-to-Point: Device to device or system to device interconnectivity reference.

L. RO: Read-only access to controller and system.

M. RW: Read and write access to controller and system.

N. Virtual: Software-coordinated.

O. Integrated Automation:
   1. ATC: Automated temperature controls.
   2. BAS: Building automation system or integrated automation for buildings.
   3. BMS: Building management system or integrated automation for buildings.
   4. DCS: Distributed control system.
   5. EIS: Energy information system or EMS with built-in data analytical tools.
   6. EMS: Energy management system.
   7. FMS: Facility management system or enterprise integrated automation.
   8. UMS: Utility Monitoring and Control System.

P. Operator Interface:
   1. AWS: Advanced workstation or administrator workstation.
   2. HMI Screen: OD or operator display or user interface (UI).

3. OD: Operator display or HMI panel screen or graphic terminal.
4. OWS: Operator's workstation or supervisory workstation.
5. SCADA: Supervisory control and data acquisition.
6. Terminal Device: Same as OD or HMI.
7. User Interface (UI): Same as OD, HMI screen or terminal device.

Q. Controllers or Local Control Units (LCUs):
1. AAC: Advanced application controller or programmable controller.
2. ASC: Application specific controller or pre-programmed controller.
3. BC: Building controller or network supervisory controller.
4. DDC: Distributed digital controller or direct digital controller.
5. NC: Network supervisory controller or building controller.
6. OEM: Original equipment manufacturer controller.
7. PAC: Programmable automation controller.
8. PLC: Programmable logical controller.
9. RTU: Remote terminal unit or small DDC, ASC, SA or SS.
10. SA: Smart actuator or network-connected actuated device.
11. Smart I/O or I/O: Remote input-output device.
12. SS: Smart sensor or network-connected sensor.

R. Communication:
1. BBMD: Broadcast management device.
2. GEN: General.
3. GW: Gateway.
4. Protocol: Communications language, default to BACnet MS/TP for field devices and BACnet/IP for supervisory devices unless otherwise indicated per ASHRAE Std 135.
5. RTR: Router.

1.04 REFERENCE STANDARDS

A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Errata (2023).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Interconnectivity Coordination:
1. Furnish and install control and monitoring products with appurtenances external to Divisions 23 and 25 ensuring full Division 25 compatibility of direct or integrated interconnectivity.

B. Comply with existing Owner controls standards. Wayne State University "**Cohn Nursing Renovation - Building Automation System (BAS) Standard**" is appended to the specifications.

C. Comply with existing Owner Information Technology standards and procedures to interface existing equipment, devices, and networks. Wayne State University "**Cohn Nursing Renovation - Building Automation System (BAS) Standard**" is appended to the specifications.

1.06 GENERAL REQUIREMENTS

A. Ability to Self-Perform Requirements
1. All hardware and software must support the university’s BAS team to self-perform all manner of maintenance, repairs, replacements, changes to configuration, programming, and commissioning of the system and its components. Requirements to support this include, but are not limited to, the following:

a. All components must be available for direct purchase by the university.
b. All software, licenses, communication adapters, and training used by the installing contractors must be available to the university
c. Planned BAS controller make and model line is to be disclosed with the bid
d. The name and version of the software tools needed to configure and program the field hardware devices shall be included with the bid. If the university does not already possess them, they must be provided.
e. Admin login credentials shall be provided for every controller and software installed

1.07 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Installer's qualification statement.

C. IT Submittal: Detailed network riser drawings to Owner's IT division and Architect for review.

D. Submittal Package:
1. Title sheet.
2. Detail Drawings:
a. LCU per Section 251400.
b. I-O device terminations including wire and cable schedules.
c. Panel-mounted or junction box-mounted products.
d. Network terminations including wire, cable, and fiber schedules.
3. Network Riser Drawings:
a. Detailed single line diagram indicating:
1) Operator interfaces, controllers, and networking components.
2) Location Reference: Specific building room where device is to be located.
3) Address Reference: IP or subnet-instance address per device. Show common subnet mask and gateway addresses with firewall on each sheet.
4) Bill of Materials: Installed products including software.
b. Graphic panel samples of HMI network riser interface if different than main diagrams.
c. HMI Navigation Scheme: Indicating smaller graphic panel samples for proposed system navigation.
4. System or Equipment Drawings:
a. System and equipment schematic diagrams.
b. I-O Riser Schematics: Controller connectivity diagrams and controller schedule references for typical work, including, but not limited to, packaged equipment and terminal units.
c. Panel Diagrams: Sub-panels, terminal devices per Section 253500 and complete bill of materials.
d. I-O Schedules: Bill of materials and sequence of operations.
e. Graphic Panels: Proposed samples.
5. Integrated Device Drawings: 'System or Equipment Drawings' format, include object (point) reference tables.
6. Product Data: Product data sheets for each item for this project, with components and accessories.

E. Closeout or As-Build:
1. A spreadsheet of all BACnet and IP devices shall be provided to the university. The spreadsheet must include the following information:
a. Device name or identifier (VAV box number, etc)
b. Device location
c. Device model number

d. Device MAC address
e. Which controller supervises the device
f. The equipment that serves the VAV box or FCU (Which air handler)
g. The space the device serves (room number, etc)

2. As-built documents for full BAS installation, including all drawings, tables, point identifications, operating sequences, set-points, final copies of all program files (PPCL, .CAF, etc), application type or application number, etc. shall be provided with project closeout documents.
3. Software Schedules: List all installed software including controller codes and include a soft-copy of each for Owner use.
4. O&M Data: List of components with part numbers, sources of supply, and operation and maintenance instructions.
5. Software: Copy of software provided under this section.
6. Warranty executed in Owner's name.

1.08 QUALITY ASSURANCE

A. Equipment shall be installed by one of the following:
1. Siemens Building Technologies local branch
2. Syenergy Engineering
3. Johnson Controls Inc
4. Automated Logic

B. Provide products of the latest technology available unless specified.

C. All components must be available for direct purchase by the university.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 INSTALLATION

A. All systems shall be integrated into the Wayne State University campus wide BACnet network. All designs shall incorporate all hardware, software, conversion devices, etc. necessary to affect a fully functional system.

B. All IP devices shall be configured to use the IP address that will be provided by the university

C. All BACnet devices shall be configured with the BACnet instance ID provided by the university for that specific device

D. All device networks created shall be configured with a network ID provided by the university.

E. Coordinate flow stations flow stations, flow probes, pipe wells, pressure sensor tips, valves, dampers, meters, actuators, air compressors, and accessories with Division 23 requirements.

F. Coordinate power meters, current sensors, current switches, and accessories with Division 26 requirements.

G. Raceways, Cable, and Wires: Install per NECA 1 following project proposed or pre-defined routes. Field verify and ensure that installed items will not inhibit access to any device or limit service clearances of nearby equipment.

H. Terminations: Leave minimum 4-inch (102 mm) of loop per cable or wire end to ease future servicing needs. Accommodate excess neatly turned into a loop inside junction box, device access box or control panel wire duct as applicable.

I. Panel-mounted Items: Install per NECA 1 and leave a minimum sub-panel blank space capacity of 20 percent. Cap any unused panel box penetrations.

J. Identification: Identify and tag installed components as follows:

1. Panels:
   a. Door: Fasten a 1-1/4 inch (32 mm) blue nameplate tag with 1 inch (26 mm) white characters.
2. Raceway, Cable and Wires: Comply with Section 260553. Tag each cable or conductor with both hardware and software tags when different. Include the power supply voltage only on the conductors powering the end device. Label hardwired interlocks as "Safety Interlocks".
3. Communication cables, whether ethernet, twisted pair, or other, shall be labeled on both ends with the WSU CIT network jack number or supervisory device their connectivity originates from.
4. Wiring to sensors and actuators shall be labeled on both ends with the point name
5. Sensors and actuators shall be labeled on the device or box the device is mounted in. The labels must include the point name and be visible without removing covers.
6. Low voltage power wiring to controllers must be labeled with the transformer identifier if the transformer is not adjacent to the controller (such as a transformer that serves multiple terminal controllers).
7. Transformers that serve more than one controller shall be labeled with their identifier
8. Other devices: Comply with Section 230553 requirements.

K. Passive Sensors Signal Adjustment: Measure and add sensor wiring resistance to controller input definition settings to ensure accurate temperature readings.

L. Control Schematics: Provide wall-fastened laminated copy of related drawings such as schematics, wiring diagrams, schedules, and sequences of operation per system or equipment.

3.02 FIELD QUALITY CONTROL

A. See section 014000 - Quality Requirements, for additional quality requirements.

B. Verify that products were installed per manufacturer instructions.

C. TAB Support: Provide a minimum of two (2) resources to assist with test requirements specified in Section 230593 for one week.

D. Field Verifications:
1. Test LCU to I-O wiring and verify field raceway and cable tags.
2. Test LCU programming and apply cable resistance differences to passive devices.
3. Test LCU controllability and tune loops until attaining specified performance.
4. Test HMI to LCU connectivity wiring links and verify raceway and cable tags.
5. Test LCU-related HMI configuration such as panels, interface navigation, and alarms.
6. Test LCU-related HMI schedules, data logging setup and report generation features.
7. Completion: Mark LCU-related submittal sheets, schedules, and graphic panels upon completion of listed field verifications and include with submittals.

3.03 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation of system to Owner's personnel.
1. Use operation and maintenance data as reference during demonstration.
2. Briefly describe function, operation, and maintenance of each component.

B. Training: Train Owner's personnel on operation and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Training used by the installing contractors must be available to the Owner.
3. Site-specific training on the implemented BAS equipment and graphics interface shall be provided, including operations and making changes to the graphics.

4. Provide minimum of two hours of training.

END OF SECTION 250500

SECTION 251400
INTEGRATED AUTOMATION LOCAL CONTROL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Application Specific Controllers (ASC):
   1. Terminal unit controller.

1.02 RELATED REQUIREMENTS

A. Conform to Wayne State University "**Cohn Nursing Renovation - Building Automation System (BAS) Standard**" appended to the specifications.

B. Section 233600 - Air Terminal Units.

C. Section 250500 - Common Work Results for Integrated Automation.

1.03 REFERENCE STANDARDS

A. ASHRAE RP-1455 - Seminar 65 - Standardized Best of Class Sequences for HVAC Systems; 2016.

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 250500 for additional submittal requirements. Unless otherwise indicated, submittals may be arranged according to individual sections and submitted separately or combined into comprehensive packages covering the work of this division.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Local Control Unit (LCU) Level:
   1. LCU Alias: Direct Digital Controllers or DDC.
   2. Communications: Non-IP primary unless stated otherwise.
   3. Graphic Panels:
      a. Software-based loaded on central interface. Use Owner-provided standard.
   4. DDC Mounting:
      a. Terminal-unit, Factory: Ship to unit manufacturer factory for installation and testing.
      b. Terminal-unit, Field: Fit into manufacturer-provided enclosure with accessories.
   5. Energy Conservation Management Sequences:
      a. Date and Time-Clock: Automatically synchronize these from central interface.
      b. Schedules or Off-Hour Controls:
         1) Configure a 7-day time schedule for equipment with zones per occupancy type.
         2) Allow schedules to be user adjustable and overridden.

3) Configure holidays and other Owner-defined days to be repeated each year.
4) Once active, set associated zones in Occupied Mode and related equipment "on."
5) Set zones and equipment into Unoccupied Mode at the end of daily occupancy.
6) Index equipment "off" at the end of the day clock-based duration.

c. Occupied Mode:
1) Set per Owner-defined schedule with occupancy sensor override.
2) Include zone-related lighting controls within this mode and enable separate schedule for external building lights.

d. Unoccupied Mode:
1) Apply preconfigured zone and equipment setpoint setback where available otherwise index associated equipment to "off."
2) Configure internal DDC timer to index zone back to Occupied Mode for two hours or other adjustable duration when local occupancy sensor or zone override momentary switch is activated.
3) Configure card-key access controls to be used as Occupied Mode override in lieu of occupancy sensors and override momentary switches.

e. Optimum Start (Preoccupancy Building Warmup), Cooldown:
1) Configure DDC to start zone or equipment control sequences earlier than scheduled to have setpoint matched at the beginning of the scheduled interval.
2) Optimum Stop: Configure DDC to stop zone or equipment control sequences earlier than scheduled to reduce energy usage.

f. Deadband: Configure a 5 degree F (5 degree C) buffer range between heating and cooling modes to avoid simultaneous use.

g. Fault Detection and Diagnostics (FDD):
1) Enable when preconfigured or configure these per ASHRAE Std 90.1 I-P guidelines. Initiate system alarm when active.
2) Configure DDC diagnostics to show on graphic panels maintenance status such as internal errors, drained backup battery, offline status, and other active faults.

B. Enclosure:
1. Provide as control panels to house controllers, instrumentation, and other devices.
2. Type: UL 50 or UL 50E smooth, hinged metallic enclosure for non-hazardous use located:
a. Indoors, Plenums, and Electrical Rooms: Use NEMA 250, Type 1.
3. Minimum Size: 24 by 24 inch (610 by 610 mm), include backplane and key-lockable lever door handle.
4. Blank Space: Include a 20 percent internal space allowance for incidentals.
5. Self-Supporting Structure: Provide metal channel (strut) framing system and related hardware to mount box on the floor or wall end next to equipment.

C. Field Signaling:
1. Wired Signals: Multiconductor cable, as prescribed by DDC manufacturer.
2. Raceway: EMT and armored flexible conduit with compression fittings, indoors; rigid and liquid tight conduit outdoors, in compliance with NFPA 70 unless indicated otherwise.

2.02 APPLICATION SPECIFIC CONTROLLERS

A. Terminal Unit Controller:
1. Manufacturers:
a. Johnson Controls
b. Siemens Building Technologies
c. Automated Logic
2. Application: Typical for variable air volume box (VAV).

3. Inputs: 4-thermistor or dry contact, 2-universal and flow sensor.
4. Outputs: 4-binary, 2-binary (internal), and integrated actuator.
5. Actuator: Electrically-operated reversible-type with a 90 seconds stroke.
6. Subnet Communications: BACnet MS/TP data bus unless MSTP or other protocol is required to support existing devices
7. Memory: 512 Kb non-volatile battery-backed with a 16-bit memory bus.
8. Accessories:
   a. Transformers, on-off switch, relays, transducers, vinyl-metallic adhesive identification tags, and programing software.
9. Mounting:
   a. Factory: Ship to terminal unit facility or deliver to Section 233600 manufacturer for factory-mounting and testing as a complete assembly.

B. Wire Terminations: Controller and devices to include removable wire terminals.

C. Control Sequences: Based on ASHRAE RP-1455 for airside applications and ASHRAE Std 90.1 I-P for waterside applications.

PART 3 EXECUTION

3.01 INSTALLATION

A. Network: Install communication bus between controllers to allow system interface through dedicated workstation, terminal device, and web server.

B. See Section 250500 for related installation and execution requirements.

C. Programming: Configure, download, test, and debug software codes per controller type to match intended application specific, custom, or project-drawing-listed sequences of operation.

END OF SECTION 251400

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SECTION 253513
INTEGRATED AUTOMATION ACTUATORS AND OPERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric actuators.

1.02 RELATED REQUIREMENTS

A. Conform to Wayne State University "**Cohn Nursing Renovation - Building Automation System (BAS) Standard**" appended to the specifications.

B. Section 250500 - Common Work Results for Integrated Automation.

C. Section 253519 - Integrated Automation Control Valves.

D. Section 253523 - Integrated Automation Control Dampers.

1.03 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

B. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

C. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 250500 for submittal requirements.

C. Submit products of this section as integral components of control valves specified in Section 253519 and control dampers specified in Section 253523. Unless otherwise indicated, submittals may be arranged according to interrelated sections and submitted separately or combined into comprehensive package covering work of this division.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Johnson Controls

B. Siemens Building Technologies

C. Automated Logic

2.02 ACTUATORS AND OPERATORS - GENERAL

A. Actuator Capacity: Next torque size above calculated load requirement for single units. Increase selected capacity by 25 percent when multiple units are required.

B. Assembly: Products field-installed into scheduled dampers and valves.

2.03 ELECTRIC ACTUATORS

A. Mechanical Configuration:
   1. Proportional (Modulated):
      a. Input: 0 to 10 VDC.
      b. Position Feedback: 0 to 10 VDC.
      c. Stroke Duration: 60 seconds.

B. Enclosure Rating: Listed as complying with NEMA 250 and UL 50 or UL 50E use in non-hazardous locations such as:

PART 3 EXECUTION

3.01 INSTALLATION

A. Designate actuators and related accessories for factory assembly on assigned device in the form of valve or damper assembly. In turn assembly is to be handled by applicable installers in accordance with Division 23 requirements.

B. Terminations: Leave a minimum of 4 inch (102 mm) of loop per cable or wire end to ease future servicing needs. Accommodate excess neatly turned into a loop inside junction or actuator access box.

C. See Section 250500 for other related installation and execution requirements.

END OF SECTION 253513

SECTION 253516
INTEGRATED AUTOMATION SENSORS AND TRANSMITTERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temperature sensors.

B. Pressure and pressure differential sensors.

1.02 RELATED REQUIREMENTS

A. Conform to Wayne State University "**Cohn Nursing Renovation - Building Automation System (BAS) Standard**" appended to the specifications.

B. Section 232113 - Hydronic Piping: Installation of pipe-mounted devices.

C. Section 232213 - Steam and Condensate Heating Piping: Installation of pipe-mounted devices.

D. Section 233300 - Air Duct Accessories: Installation of duct-mounted devices.

E. Section 250500 - Common Work Results for Integrated Automation.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 250500 for additional submittal requirements. Unless otherwise indicated, submittals may be arranged according to individual sections and submitted separately or combined into comprehensive package covering work of this division.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Unless otherwise indicated, each sensor provided accuracy is to be within one percent of its full-scale measuring span.

B. Select devices such that their expected measured value or setpoints are at mid-span.

C. Sensor and Switch Identification:
   1. Tag: Custom metalized polyester label, printed.
   2. Size: 1/2 by 1-1/2 inches (12.7 by 38.1 mm).

2.02 TEMPERATURE SENSORS

A. Manufacturers:
   1. Johnson Controls
   2. Siemens Building Technologies
   3. Automated Logic

B. Room or Zone Thermostat:
   1. Sensor: Platinum thin-film RTD element, 1,000 ohms at 70 degrees F (21 degrees C) element inside insulated thermoplastic enclosure.
   2. Monitoring Range: From 32 to 104 degrees F (0 to 40 degrees C).
   3. Mounting: Wall box mounting pad or base.
   4. Combined Sensor Monitoring Range:
      a. Humidity: 0 to 100 percent (noncondensing).
      b. CO2 (Carbon dioxide): 0 to 2,000 ppm.
   5. Built-in Controller: Digital.
   6. Output: Two-wire, 0 to 10 VDC.
   7. Connection: Screw terminal block.

2.03 PRESSURE AND PRESSURE DIFFERENTIAL SENSORS

A. Differential Pressure Sensors:
   1. Measurement: Apply for static pressure.
   2. Mounting Style: DIN-rail, duct, outdoor, surface, or wall box, single gang.
   3. Airflow Monitoring Range: 0 to 0.25 in-wc (0 to 62.2 Pa).
   4. Response Time: 30 to 50 milliseconds.
   5. Linearity: 0.1 percent of calibrated span.
   6. Minimum Overpressure: 150 percent over highest range value.
   7. Power Input: None, device is loop-powered.
   8. Output: Two-wire, 0 to 10 VDC.
   9. Hi/Lo Port to Tip/Sensor Tube Material: Polyvinyl, black.
   10. Process Connection: 1 inch (25 mm).

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide and install products as indicated on project drawings or manufacturer-provided schematics.

B. Install in accordance with Sections 232113, 232213, and 233300.

C. See Section 250500 for other related installation and execution requirements.

END OF SECTION 253516

SECTION 253519
INTEGRATED AUTOMATION CONTROL VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure-independent control valves.

1.02 RELATED REQUIREMENTS

A. Conform to Wayne State University "**Cohn Nursing Renovation - Building Automation System (BAS) Standard**" appended to the specifications.

B. Section 232113 - Hydronic Piping: Control valve installation.

C. Section 232213 - Steam and Condensate Heating Piping: Control valve installation.

D. Section 250500 - Common Work Results for Integrated Automation.

E. Section 253513 - Integrated Automation Actuators and Operators.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. See Section 250500 for additional submittal requirements. Unless otherwise indicated, submittals may be arranged according to individual sections and submitted separately or combined into comprehensive packages covering the work of this division.

C. Provide valve schedule including associated actuator and potential manual operator.

D. Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of the product.

1.04 QUALITY ASSURANCE

A. Products: Listed, classified, and labeled as suitable for the purpose intended.

B. Schedule Confirmation: Review approved equipment submittals to confirm design data specifics like flow, pressure difference (coil or system), service temperature to confirm selections.

1.05 DELIVERY STORAGE AND HANDLING

PART 2 PRODUCTS

2.01 VALVES - GENERAL REQUIREMENTS

A. Valve Assembly: Provide commercial-grade valve type unless otherwise indicated.

B. Actuators: Where possible by the same valve manufacturer in compliance with Section 253513.

C. Identification Tag: Custom round type, brass, engraved.
   1. Information: Show Cv or Kv with fail setting.
   2. Fastened: Beaded chain, brass.

D. Valve Selection:
   1. Flow Characteristic:
      a. Equal Percentage: Water, brine and liquid service.
      b. Linear: Steam service.
   2. Sizing:
      a. Pipe Line Size: Use for 2-position (open/close) and solenoid types.

b. Cv or Kv (Valve Coefficient): Size using expected load flow and pressure drop across branch which includes coil, pipe, and fittings.

3. Materials:
   a. Manufacturer suggested trim, seal and seat ring.
   b. Stainless steel trim and replaceable seat ring for:

E. Manufacturers:
1. Johnson Controls
2. Siemens Building Technologies
3. Automated Logic

2.02 PRESSURE-INDEPENDENT CONTROL VALVES

A. Construction: No cartridges requiring replacement or maintenance.
1. Sizes 2 inches, NPS (50 mm, DN) and Smaller: PN 16, stainless steel components.

B. Accuracy:
1. Size 3/4 inch, NPS (20 mm, DN) and Smaller:
   a. Low and Standard Flow Units: Set-flow within 2.3 to 58 psi (16 to 399.8 kPa) differential pressure range across 0 to 100 percent of rated flow.
   b. High Flow Units: Within 5 percent of set-flow between 5 to 58 psi (34.5 to 399.8 kPa) differential pressure range across 0 to 100 percent of rated flow.
2. Size 1 to 1-1/4 inches, NPS (25 to 32 mm, DN):
   a. Standard Flow Units: Set-flow within 2.9 to 58 psi (19.9 to 399.8 kPa) differential pressure range across 0 to 100 percent of rated flow.
   b. High Flow Units: Within 5 percent of set-flow between 5 to 58 psi (34.5 to 399.8 kPa) differential pressure range across 0 to 100 percent of rated flow.
3. Size 1-1/2 to 4 inches, NPS (40 to 100 mm, DN):
   a. Within 5 percent of set-flow within 4.35 to 58 psi (29.9 to 399.8 kPa) differential pressure range across 0 to 100 percent of rated flow.

C. Flow Characteristics: Linear control or equal percentage, selectable at valve actuator side.

D. Flow Adjust: Field adjustable using percentage of rated valve flow setting.

E. Position Feedback: Output signal integrated into proportional actuator.

F. Authority: 100 percent with modulation below 1 percent regardless of flow settings.

G. Close-Off Rating: 232 psi (1599.6 kPa) regardless of valve size.

PART 3 EXECUTION

3.01 INSTALLATION

A. Designate valves and related accessories for installation to be handled by applicable installers in accordance requirements listed in Sections 232113 and 232213

B. See Section 250500 for other related installation and execution requirements.

END OF SECTION 253519

SECTION 260505
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that abandoned wiring and equipment serve only abandoned facilities.

B. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. PCB- and DEHP-containing lighting ballasts.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

3.04 CLEANING AND REPAIR

A. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION 260505

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wiring connectors.

D. Electrical tape.

E. Heat shrink tubing.

F. Oxide inhibiting compound.

G. Wire pulling lubricant.

H. Cable ties.

I. Firestop sleeves.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.

C. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 284600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.

F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

H. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

J. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

O. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

P. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

Q. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

R. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

S. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
      b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 260526.

H. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

I. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 150 feet (46 m): 10 AWG, for voltage drop.
   2. Control Circuits: 14 AWG.

J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

K. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
   3. Color Code:
      a. Equipment Ground, All Systems: Green.
      b. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Southwire Company: www.southwire.com/#sle.
      b. Triangle.
      c. Rome.
      d. Cablec

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid.

b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
a. Size 4 AWG and Larger: Type XHHW-2.
b. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.04 METAL-CLAD CABLE

A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

B. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

E. Grounding: Full-size integral equipment grounding conductor.

F. Armor: Steel, interlocked tape.

2.05 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 260526.

C. Wiring Connectors for Splices and Taps:

D. Wiring Connectors for Terminations:

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

H. Mechanical Connectors: Provide bolted type or set-screw type.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Ilsco: www.ilsco.com/#sle.
c. Square D.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Ilsco: www.ilsco.com/#sle.
c. GB Electric

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
1. Manufacturers:

a. Burndy LLC: www.burndy.com/#sle.
b. Ilsco: www.ilsco.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

2.06 ACCESSORIES

A. Electrical Tape:
1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.
4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil (3.2 mm); suitable for continuous temperature environment up to 176 degrees F (80 degrees C).
5. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil (0.18 mm); suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

D. Wire Pulling Lubricant:
1. Listed and labeled as complying with UL 267.
2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
3. Suitable for use at installation temperature.

E. Cable Ties: Material and tensile strength rating suitable for application.

F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.

G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location indicated.
   5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
      a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
      b. Increase size of conductors as required to account for ampacity derating.
      c. Size raceways, boxes, etc. to accommodate conductors.
   7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

H. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

I. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.

J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

L. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
   3. Wet Locations: Use heat shrink tubing.

N. Insulate ends of spare conductors using vinyl insulating electrical tape.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

P. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 260519

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SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical

conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal air ducts.

F. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
b. Raceway Size: 3/4 inch (21 mm) trade size unless otherwise indicated or required.
c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
1. Use insulated copper conductors unless otherwise indicated.
a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION 260526

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SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

C. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

D. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 033000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

D. Metal Channel/Strut Framing Systems:
   1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
   2. Comply with MFMA-4.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: See Section 260533.13 for additional requirements.

I. Interior Luminaire Support and Attachment: See Section 265100 for additional requirements.

J. Secure fasteners in accordance with manufacturer's recommended torque settings.

K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 260529

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SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Galvanized steel intermediate metal conduit (IMC).

C. Flexible metal conduit (FMC).

D. Liquidtight flexible metal conduit (LFMC).

E. Galvanized steel electrical metallic tubing (EMT).

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260533.16 - Boxes for Electrical Systems.

E. Section 260533.23 - Surface Raceways for Electrical Systems.

F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

I. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

J. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

K. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

L. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

M. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.

3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

D. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

E. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

F. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

G. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

H. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.

C. Fittings for Grounding and Bonding: See Section 260526 for additional requirements.

D. Provide conduit, fittings, supports, and accessories required for complete raceway system.

E. Provide products listed, classified, and labeled as suitable for purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4-inch (21 mm) trade size.
   2. Branch Circuit Homeruns: 3/4-inch (21 mm) trade size.
   3. Control Circuits: 1/2-inch (16 mm) trade size.
   4. Flexible Connections to Luminaires: 3/8-inch (12 mm) trade size.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Triangle PWC
   3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Triangle PMC
   3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:

B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

2.06 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Triangle PWC
   3. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression/gland or set-screw type.
      a. Do not use indenter type connectors and couplings.

2.07 ACCESSORIES

A. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

B. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kN).

C. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.

D. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.

E. Conduit Routing:
   1. Arrange conduit to maintain adequate headroom, clearances, and access.
   2. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
   3. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
   4. Route conduits above water and drain piping where possible.
   5. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   6. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.

F. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
9. Use of wire for support of conduits is not permitted.

G. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
5. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
6. Secure joints and connections to provide mechanical strength and electrical continuity.

H. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
7. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 078400.

I. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

J. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
   a. Where conduits pass from outdoors into conditioned interior spaces.
   b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

K. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.

L. Provide grounding and bonding; see Section 260526.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 260533.13

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

D. Section 260533.23 - Surface Raceways for Electrical Systems:

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 262726 - Wiring Devices:
   1. Wall plates.

G. Section 262813 - Fuses: Spare fuse cabinets.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working

clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.

11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
12. Minimum Box Size, Unless Otherwise Indicated:
    a. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
13. Wall Plates: Comply with Section 262726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

2.02 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

F. Box Locations:
1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes so that wall plates do not span different building finishes.
4. Locate boxes so that wall plates do not cross masonry joints.
5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
7. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.
8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
10. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

G. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

H. Install boxes plumb and level.

I. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.

J. Install boxes as required to preserve insulation integrity.

K. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

L. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

M. Close unused box openings.

N. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

O. Provide grounding and bonding in accordance with Section 260526.

P. Identify boxes in accordance with Section 260553.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 260533.16

SECTION 260533.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface raceway systems.

B. Wireways.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.13 - Conduit for Electrical Systems.

D. Section 260533.16 - Boxes for Electrical Systems.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 262726 - Wiring Devices: Receptacles.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA PRP 5 - Installation Guidelines for Surface Nonmetallic Raceway; 2021.

E. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.

F. UL 5A - Nonmetallic Surface Raceways and Fittings; Current Edition, Including All Revisions.

G. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate rough-in locations of outlet boxes provided under Section 260533.16 and conduit provided under Section 260533.13 as required for installation of raceways provided under this section.
   3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install raceways until final surface finishes and painting are complete.
   2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS

A. Manufacturers:
   1. MonoSystems, Inc: www.monosystems.com/#sle.
   2. Thomas & Betts.
   3. Walker Systems.
   4. Wiremold.

B. Surface Metal Raceways: Listed and labeled as complying with UL 5.

C. Surface Nonmetallic Raceways: Listed and labeled as complying with UL 5A.

2.03 WIREWAYS

A. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.

B. Wireway Type, Unless Otherwise Indicated:
   1. Indoor Clean, Dry Locations: NEMA 250, Type 1, painted steel with screw-cover.

C. Finish for Painted Steel Wireways: Manufacturer's standard grey unless otherwise indicated.

D. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.

C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Surface Nonmetallic Raceways: Install in accordance with NEMA PRP 5.

D. Install raceways plumb and level.

E. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.

F. Secure and support raceways in accordance with Section 260529 at intervals complying with NFPA 70 and manufacturer's requirements.

G. Close unused raceway openings.

H. Provide grounding and bonding in accordance with Section 260526.

I. Identify raceways in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect raceways for damage and defects.

C. Correct wiring deficiencies and replace damaged or defective raceways.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 PROTECTION

A. Protect installed raceways from subsequent construction operations.

END OF SECTION 260533.23

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SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 262726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.06 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Identify voltage and phase.
         2) Identify power source and circuit number. Include location when not within sight of equipment.

3) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
4) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.

2. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
3. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.

C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
a. Within boxes when more than one circuit is present.

D. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet (6.1 m).

E. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.

F. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 262726.
2. Use identification label to identify fire alarm system devices.

G. Identification for Luminaires:

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Materials:
2. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
2. Legend:
a. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height:
   a. Equipment Designation: 1/2 inch (13 mm).
5. Color:
   a. Normal Power System: White text on black background.
   b. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch (6 mm).
5. Color: Black text on white background unless otherwise indicated.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches (51 mm) by 4 inches (100 mm).
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch (13 mm).
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Black text on clear background.

G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch (3 mm).

F. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

C. Minimum Size:
   1. Markers for Equipment: 1 1/8 by 4 1/2 inches (29 by 110 mm).
   2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
   3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
   4. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).

D. Legend:
   1. Markers for Voltage Identification: Highest voltage present.

E. Color: Black text on orange background unless otherwise indicated.

2.05 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
   2. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 260553

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SECTION 260583
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260533.13 - Conduit for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 262726 - Wiring Devices.

E. Section 262816.16 - Enclosed Switches.

F. Section 262913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Comply with NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 262816.16 and in individual equipment sections.

C. Wiring Devices: As specified in Section 262726.

D. Flexible Conduit: As specified in Section 260533.13.

E. Wire and Cable: As specified in Section 260519.

F. Boxes: As specified in Section 260533.16.

2.02 EQUIPMENT CONNECTIONS

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION 260583

SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Daylighting controls.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

F. Section 262813 - Fuses.

G. Section 265100 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

D. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

C. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
   2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

D. Field Quality Control Reports.

E. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

C. Provide two year manufacturer warranty for all daylighting controls.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

A. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
      b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
      c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
      d. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.

3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
8. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.

B. Wall Switch Occupancy Sensors:
   1. All Wall Switch Occupancy Sensors:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      b. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
   2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).
   3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 400 square feet (37.2 sq m).
   4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet (83.6 sq m).

C. Wall Dimmer Occupancy Sensors:
   1. General Requirements:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
      b. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.

D. Ceiling Mounted Occupancy Sensors:
   1. All Ceiling Mounted Occupancy Sensors:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
   2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
      a. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet (111.5 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
   3. Ultrasonic Ceiling Mounted Occupancy Sensors:
      a. Medium Range Sensors: Capable of detecting motion within an area of 1,000 square feet (92.9 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.

b. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet (185.8 sq m) at a mounting height of 9 feet (2.7 m).

4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet (111.5 sq m) at a mounting height of 9 feet (2.7 m), with a field of view of 360 degrees.
5. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet (111.5 sq m) at a mounting height of 9 feet (2.7 m).

E. Directional Occupancy Sensors:
1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
2. Passive Infrared (PIR) Directional Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within a distance of 40 feet (12 m) at a mounting height of 10 feet (3.1 m).
   b. Long Range Sensors: Capable of detecting motion within a distance of 80 feet (24 m) at a mounting height of 10 feet (3.1 m).
3. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within a distance of 40 feet (12 m) at a mounting height of 10 feet (3.1 m).

F. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control the load indicated on drawings.

2.03 DAYLIGHTING CONTROLS

A. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.

B. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
1. Sensor Type: Filtered silicon photo diode.
2. Sensor Range:
   a. Indoor Photo Sensors: 5 to 100 footcandles (53.8 to 1,080 lx).
3. Finish: White unless otherwise indicated.
4. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
5. Wireless Daylighting Control Photo Sensors:
   a. RF Range: 30 feet (9 m) through typical construction materials.
   b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
   c. Power: Battery-operated with minimum ten-year battery life.

C. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.

D. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
   1. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
   2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
   3. Control Capability:

E. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
   1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
   2. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
   3. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
   4. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.

F. Power Packs for Low Voltage Daylighting Control Modules:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
   2. Input Supply Voltage: Dual rated for 120/277 V ac.
   3. Load Ratings: As required to control the load indicated on drawings.

G. Accessories:
   1. Where indicated, provide compatible accessory wall switches for manual override control.

2.04 ACCESSORIES

A. Auxiliary Contacts:
   1. Comply with NEMA ICS 5.
   2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of lighting control devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 48 inches (1.2 m) above finished floor.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
   3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.

G. Provide required supports in accordance with Section 260529.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Identify lighting control devices in accordance with Section 260553.

J. Occupancy Sensor Locations:
   1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

K. Daylighting Control Photo Sensor Locations:
   1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize control and avoid conflicts or problems affecting proper detection of light levels.
   2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.

3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

L. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

M. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

E. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

E. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

A. See Section 019113 - General Commissioning Requirements for commissioning requirements.

3.08 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

END OF SECTION 260923

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SECTION 262416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lighting and appliance panelboards.

B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less; 2023.

G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

N. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
1. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Source Limitations: Provide panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
1. Altitude: Less than 6,600 feet (2,000 m).
2. Ambient Temperature:
a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

C. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1.
2. Boxes: Galvanized steel unless otherwise indicated.
a. Provide wiring gutters sized to accommodate the conductors to be installed.
3. Fronts:
a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Aluminum.
3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
         1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
         2) 14,000 rms symmetrical amperes at 480 VAC.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
   6. Provide the following circuit breaker types where indicated:
      a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
      b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   7. Do not use tandem circuit breakers.
   8. Do not use handle ties in lieu of multi-pole circuit breakers.
   9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

2.05 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 260529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.

I. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 260526.

K. Install all field-installed branch devices, components, and accessories.

L. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

M. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

N. Provide filler plates to cover unused spaces in panelboards.

O. Identify panelboards in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test GFCI circuit breakers to verify proper operation.

F. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262416

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SECTION 262726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates and covers.

E. Poke-through assemblies.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260533.16 - Boxes for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 260583 - Wiring Connections: Cords and plugs for equipment.

E. Section 260923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

F. Section 262913 - Enclosed Controllers: Manual motor starters and horsepower rated motor-starting switches without overload protection.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h, with Amendments (2017).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2014g, with Amendment (2017).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

M. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
4. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICES - GENERAL REQUIREMENTS

A. Provide wiring devices suitable for intended use with ratings adequate for load served.

B. Wiring Device Applications:
1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.
2. Provide GFCI protection for:
a. Receptacles installed within 6 feet (1.8 m) of sinks.
b. Receptacles serving electric drinking fountains.

C. Wiring Device Finishes:
1. Provide wiring device finishes as described below, unless otherwise indicated.
2. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.

2.02 WALL SWITCHES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
3. Bryant.

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.03 WALL DIMMERS

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   2. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
   3. Bryant.

B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Slide control type with separate on/off switch.

D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:

2.04 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
   3. Bryant.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
   2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
   3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. USB Charging Devices:
   1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
      a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
   2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

F. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

2.05 WALL PLATES AND COVERS

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.

2. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
3. Bryant.
4. Appleton.

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

E. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.06 POKE-THROUGH ASSEMBLIES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Thomas & Betts Corporation: www.tnb.com/#sle.
3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

C. Flush Floor Service Fittings:
1. Dual Service Flush Combination Outlets:
a. Cover: Hinged door(s).
b. Configuration:
1) Power: One standard convenience duplex receptacle(s).
2) Communications:
3) Voice and Data Jacks: Provided by others.
2. Accessories:
a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

P. Identify wiring devices in accordance with Section 260553.

Q. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 262726

SECTION 262813
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

1.02 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

B. Section 262816.16 - Enclosed Switches: Fusible switches.

C. Section 262913 - Enclosed Controllers: Fusible switches.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

C. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Enclosed Switches: See Section 262816.16.
      b. Fusible Switches for Enclosed Motor Controllers: See Section 262913.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.

B. Littelfuse, Inc: www.littelfuse.com/#sle.

C. Gould Shawmut.

2.02 APPLICATIONS

A. Individual Motor Branch Circuits: Class RK1, time-delay.

2.03 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 262813

SECTION 262816.13
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

I. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed circuit breakers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Source Limitations: Provide enclosed circuit breakers and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

D. Short Circuit Current Rating:
   1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.

E. Conductor Terminations: Suitable for use with the conductors to be installed.

F. Provide thermal magnetic circuit breakers unless otherwise indicated.

G. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
   3. Provide surface-mounted enclosures unless otherwise indicated.

I. Provide externally operable handle with means for locking in the OFF position.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:
   1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
   2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

E. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

F. Provide the following circuit breaker types where indicated:
   1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   2. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.

G. Provide the following features and accessories where indicated or where required to complete installation:
   1. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Install enclosed circuit breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

H. Identify enclosed circuit breakers in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1. Tests listed as optional are not required.

D. Test GFCI circuit breakers to verify proper operation.

E. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262816.13

SECTION 262816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 262813 - Fuses.

E. Section 262913 - Enclosed Controllers: Manual motor controllers.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Minimum Ratings:
      a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

L. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

M. Provide the following features and accessories where indicated or where required to complete installation:
   1. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262816.16

SECTION 262913
ENCLOSED CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
   1. Magnetic motor starters.
   2. General purpose contactors.
   3. Manual motor starters.
   4. Motor-starting switches without overload protection.

B. Overcurrent protective devices for motor controllers, including overload relays.

C. Control accessories:
   1. Auxiliary contacts.
   2. Pilot devices.
   3. Control and timing relays.
   4. Control power transformers.
   5. Control terminal blocks.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 262813 - Fuses: Fuses for fusible switches.

1.03 REFERENCE STANDARDS

A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.

F. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).

G. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

L. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

M. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
   3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.
   4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   6. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

2.02 ENCLOSED CONTROLLERS

A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.

D. Service Conditions:
   1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
      a. Altitude:
         1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet (1,000 m).
         2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet (2,000 m).
      b. Ambient Temperature: Between 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C).
   2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:
   1. Provide controllers with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Enclosures:
   1. Comply with NEMA ICS 6.
   2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   3. Finish: Manufacturer's standard unless otherwise indicated.

H. Instrument Transformers:
   1. Comply with IEEE C57.13.
   2. Select suitable ratio, burden, and accuracy as required for connected devices.
   3. Current Transformers: Connect secondaries to shorting terminal blocks.
   4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

I. Magnetic Motor Starters: Combination type unless otherwise indicated.
   1. Combination Magnetic Motor Starters: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
   2. Configuration: Full-voltage non-reversing unless otherwise indicated.
   3. Disconnects: Circuit breaker type.
      a. Circuit Breakers: Motor circuit protectors (magnetic-only) unless otherwise indicated or required.
      b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
      c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
   4. Overload Relays: Bimetallic thermal type unless otherwise indicated.
   5. Pilot Devices Required:
      a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.

J. General Purpose Contactors: Combination type unless otherwise indicated.
   1. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect, but without integral overload relay(s).
   2. Configuration: Full-voltage non-reversing unless otherwise indicated.
   3. Disconnects: Circuit breaker type.

a. Circuit Breakers: Thermal magnetic unless otherwise indicated or required.
b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
c. Provide auxiliary interlock for disconnection of external control power sources where applicable.

K. Manual Motor Starters:
1. Description: NEMA ICS 2, Class A manually-operated motor controllers with overload relay(s).
2. Configuration: Non-reversing unless otherwise indicated.
3. Fractional-Horsepower Manual Motor Starters:
a. Furnish with toggle operator.
b. Overload Relays: Bimetallic or melting alloy thermal type.

L. Motor-Starting Switches: Horsepower-rated switches without overload protection; toggle operator.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:
1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
3. Trip-free operation.
4. Visible trip indication.
5. Resettable.
a. Employ manual reset unless otherwise indicated.
b. Do not employ automatic reset with two-wire control.
6. Bimetallic Thermal Overload Relays:
a. Interchangeable current elements/heaters.
b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
c. Trip test function.
7. Melting Alloy Thermal Overload Relays:
a. Interchangeable current elements/heaters.

B. Fusible Disconnect Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

C. Circuit Breakers:
1. Interrupting Capacity (not applicable to motor circuit protectors):
a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
2. Motor Circuit Protectors:

a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.
b. Provide field-adjustable magnetic instantaneous trip setting.
c. Provide the following features and accessories where indicated or where required to complete installation:
1) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

3. Molded Case Circuit Breakers:
a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
1) Provide thermal magnetic circuit breakers unless otherwise indicated.
b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
c. Provide the following features and accessories where indicated or where required to complete installation:
1) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

2.04 CONTROL ACCESSORIES

A. Auxiliary Contacts:
1. Comply with NEMA ICS 5.
2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.

B. Pilot Devices:
1. Comply with NEMA ICS 5; heavy-duty type.
2. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
3. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
4. Indicating Lights: Push-to-test type unless otherwise indicated.
5. Provide LED lamp source for indicating lights and illuminated devices.

C. Control and Timing Relays:
1. Comply with NEMA ICS 5.
2. Provide number and type of relays indicated or required to perform necessary functions.

D. Control Power Transformers:
1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices.
2. Include primary and secondary fuses.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings of enclosed controllers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed controllers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install controllers in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Install enclosed controllers plumb and level.

F. Provide grounding and bonding in accordance with Section 260526.

G. Install all field-installed devices, components, and accessories.

H. Provide fuses complying with Section 262813 for fusible switches as indicated.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.

D. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

E. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1. Tests listed as optional are not required.

F. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation, adjustment, and maintenance of enclosed controllers and associated devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.07 PROTECTION

A. Protect installed enclosed controllers from subsequent construction operations.

END OF SECTION 262913

SECTION 265100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Exit signs.

C. Ballasts and drivers.

D. Lamps.

1.02 RELATED REQUIREMENTS

A. Section 260529 - Hangers and Supports for Electrical Systems.

B. Section 260533.16 - Boxes for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 260923 - Lighting Control Devices.

E. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.

1.03 REFERENCE STANDARDS

A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

C. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.

D. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

E. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

I. UL 1598 - Luminaires; Current Edition, Including All Revisions.

J. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

C. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.

2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.02 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single- or double-face as indicated or as required for installed location.
   2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
   1. Self-Powered Exit Signs:
      a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
      b. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
      c. Provide low-voltage disconnect to prevent battery damage from deep discharge.
      d. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

2.03 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.
      a. Wall Dimmers: See Section 262726.
      b. Daylighting Controls: See Section 260923.

2.04 LAMPS

A. Lamps - General Requirements:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 260529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.

H. Suspended Luminaires:
   1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

L. Install lamps in each luminaire.

M. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265100

DIVISION 27 - COMMUNICATIONS INDEX

WSU College of Nursing Renovations

HEAPY
Norr Technology Engineer
Indianapolis, IN Project No. 2024-91003

Section INDEX

JUNE, 2024

SECTION 27 05 01
BASIC COMMUNICATIONS REQUIREMENTS

PART 1 - GENERAL

1.1 Refer to Section 26 05 01 Basic Electrical Requirements which are hereby made part of Division 27 - Communications.

1.2 Special Note

A. All provisions of the Bidding Requirements, General Conditions and Supplementary Conditions, including Division 00 and Division 01, apply to work specified in this Division.

B. The scope of the Division 27 work includes furnishing, installing, testing and warranty of all work and complete Communication systems as shown on the Technology Series drawings, and as specified in Division 27 and elsewhere in the project documents.

C. The project drawings and specifications define scope of work for the various divisions. Such assignments of work are not intended to restrict the Construction Manager in assignment of work among the contractors to accommodate trade agreements and practices or the normal conduct of the construction work.

1.3 Permits and Regulations

A. Include payment of all permit and inspection fees applicable to the Division 27 work. Furnish for the Owner certificates of approval from the governing inspection agencies, as a condition for final payment.

B. Work must conform to the National Electrical Code, National Electrical Safety Code and other applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawings and specifications shall govern. Install no work contrary to minimum legal standards.

C. Upon completion of work, the Contractor shall furnish to the consulting State Architect the certificate of inspection and approval before final payment on contract will be allowed.

1.4 Applicable Standards

A. Unless specifically indicated otherwise in this document, all telecommunications infrastructure shall be designed in accordance with the following standards including all appropriate addendums and revisions:

1. ANSI/TIA-568-C Commercial Building Telecommunications Cabling Standard
2. ANSI/TIA-606-B Administration Standard for Commercial Telecommunications Infrastructure
3. ANSI J-STD-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
4. ANSI/TIA-758 Customer Owned Outside Plant Telecommunications Cabling Standard
5. BICSI Telecommunications Distribution Methods Manual (TDMM)
6. BICSI Telecommunications Cabling Installation Manual (TCIM)

7. ANSI/TIA 569-C Commercial Building Standards for Telecommunications Pathways and Spaces

1.5 Contractor Bid Eligibility Qualifications

A. The installing contractor for each telecommunications system shall have a minimum of 5 years of experience with the types of systems specified. The company and employee must be certified to install, test and warranty the product specified. This certification must be produced at the WSU mandatory pre-bid meeting, prior to a bid submittal. No exception to this will be allowed.

B. The installing contractor may be asked to submit a reference list consisting of a minimum of 3 - 5 installations of equivalent size and complexity of this contract. The reference list shall contain the following information for each installation:

1. Name of project, square footage, location and brief description of systems.
2. Date of completed installation.
3. Contact name and phone number of facility representative.
4. Total bid amount of each system installed.
5. Final contract amount of each system installed, including all change orders and bulletins.
6. The installing contractor shall submit with the bid the names and registration numbers of members of the firm that have a valid membership and are certified with BICSI as Registered Communications Distribution Designers (RCDD). This Contractor shall identify at least one RCDD assigned to this project in the bid and must be an employee of that company.

1.6 Inspection of Site

A. Inspect the project site. Conditions shall be compared with information shown on the drawings. Report immediately to the Architect \ Construction Manager any significant discrepancies which may be discovered. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

B. Prior to any construction, installation, or modification of IT facilities or systems, it shall be the contractor’s responsibility to document existing field conditions to establish a baseline in the work area. Field conditions shall include (but are not limited to) the physical condition of the existing telecommunications cabling, conduit, or facilities infrastructure, infrastructure electrical and optical performance, or any other site conditions, either above ground or underground that may be affected. It shall be the contractor’s responsibility to restore or repair any damage or deviations from the initial baseline solely at their expense.

1.7 Drawings and Specifications

A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible.

1. The word "provide", as used, shall mean "furnish and install".
2. The phrase “shall support” shall mean that no additional time, material or labor is required to have the specified referenced feature/function/capability fully operational.

3. If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect / Construction Manager for approval before proceeding with the work.

B. Make all necessary field measurements to ensure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.

C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect / Construction Manager for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having wireways and fittings fabricated and delivered in advance of making actual measurements shall not be sufficient cause to avoid making offsets and minor changes as may be necessary to install wireways, fittings and equipment.

1. Where there are quantity discrepancies of equipment shown on drawings and/or specifications, the Contractor shall provide the greater quantity.

D. The Architect / Construction Manager shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of protecting and concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.

E. Equipment, ductwork, piping and communications wiring shall not be installed in the dedicated electrical space above or in the working space required around electrical switchgear, motor control centers or panelboards as identified by NEC 110.26 Spaces About Electrical Equipment – 600 Volts Nominal or Less. For equipment rated over 600 volts nominal – 110.32 Work Space About Equipment – 110.33 Entrance and Access to Work Space – 110.34 Work Space and Guarding. Caution other trades to comply with this stipulation.

F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect's / Construction Manager’s decision shall be final in regard to the arrangement of conduit, etc., where conflict arises.

G. Provide offsets in system runs, additional fittings, necessary conduit, pull boxes, conductors, switches and devices required to complete the installation, or for the proper operation of the system. Exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.

H. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect / Construction Manager. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect / Construction Manager.

1.8 Coordination Drawings

A. Each Contractor shall prepare their own electronic drawings, using common backgrounds obtained from the Architect or Engineer. The Division 27 & 28 Contractors shall be responsible for consolidating (merging) the drawings into combined coordination drawings, and lead the conflict resolution process, with all contractors working together to obtain finished coordinated drawings. No work shall be installed until all contractors have approved and signed-off with their approval and drawings have been submitted and reviewed by the Engineer.

B. Review by the Engineer is cursory. It is the Contractors responsibilities to ensure that all work is coordinated, including fit above ceilings and that specified ceiling heights are maintained.

C. Refer to Divisions 00 and 01 for final requirements.

1.9 Inspection

A. All work shall be subject to inspection of Federal, State and local agencies as may be appropriate, and of the Architect and Engineer.

B. Obtain final inspection certificates and turn over to the Owner.

1.10 Record Drawings

A. Maintain a separate set of field prints of the contract documents and show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work and within 90 days of system acceptance, these drawings shall be turned over to the Architect / Construction Manager. This shall apply particularly to underground and concealed work, and to other systems where the installation varies to a degree which would justify recording the change.

1.11 Operating and Maintenance Manuals

A. Assemble electronic copies each of operating and maintenance manuals for the Communications work.

B. All “approved” shop drawings and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams, parts list, and other information, along with warranties, shall be obtained from each manufacturer of the principal items of equipment. In addition, prepare and include a chart listing all items of equipment which are furnished under this contract, indicating the nature of maintenance required, the recommended frequency of checking these points and the type of replacement material required. Name and address of a qualified service agency.

C. Standard NEMA publications on the operation and care of equipment may be furnished in lieu of manufacturer's data where the manufacturer's instructions are not available.

D. Original purchase order number, date of purchase, name, address, and phone number of the vendor warranty information.

E. Copy of required test reports.

F. These shall be submitted to the Engineer and / Construction Manager for review. Upon approval, manuals shall be turned over to the Owner.

G. O&M Manuals shall contain the following information at a minimum:

1. Copies of all approved shop drawings with the Engineer's stamp.
2. Owner's manuals for every item of equipment when available from the manufacturer. These shall be the technical manuals provided by the manufacturer and shall not consist of generic sales brochures. Technical manuals shall provide complete specifications for the equipment as well as complete operating, maintenance, troubleshooting and product repair/replacement information. Where available only in electronic format, the contractor may provide a CD with electronic versions of Owner's manuals. CDs containing electronic versions of Owner's manuals must contain the proper software viewers for each document type.
3. Communications drawings updated with final as-built information. This shall be in the form of a complete set of Communications drawings with as-built information indicated in colored pen based upon actual field conditions.
4. System schematic and block diagrams for every system updated with final as-built information. These drawings shall define the exact arrangement of each system including wiring configuration, device locations and cable types.

1.12 Final Inspection and Punch List

A. As the time of work completion approaches, survey and inspect Division 27 work and develop a punch list to confirm that it is complete and finished. Then notify the Architect and Construction Manager and request that a final inspection be made. It shall not be considered the Architect's or Engineer's obligation to perform a final inspection until the Contractor has inspected the work and so states at the time of the request for the final inspection.

B. Requests to the Engineer or Construction Manager for final inspection may be accompanied by a limited list of known deficiencies in completion, with appropriate explanation and schedule for completing these; this is in the interest of expediting acceptance for beneficial occupancy.

C. The Engineer will inspect the work and prepare a punch list of items requiring correction, completion or verification. Corrective action shall be taken by the Contractor to the satisfaction of Architect and Engineer within 30 days of receipt of the Engineer's punch list.

D. The FP&M and C&IT staff will make periodic construction visits to observe the installation for conformance to project specifications, proper installation practices and the adherence to C&IT standards for telecommunication infrastructure. Any out of compliance items shall be noted to the project team.

E. The FP&M and C&IT project managers will perform a final punch list of all telecommunication systems installed.

1.13 Warranty

A. Warrant all workmanship, equipment and material entering into this contract for a period of one (1) year **or the period of time as per specific specification section,** from date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect or Construction Manager. Any materials or equipment proving to be defective during the warranty period shall be made good without expense to the Owner. The use of equipment for temporary communication systems is not the start of the warranty period.

B. This provision is intended specifically to cover deficiencies in contract completion or performance which are not immediately discovered after systems are placed in operation. These items include but are not limited to replacement of malfunctioning equipment and adjusting special equipment and communication systems to obtain optimum performance.

C. This provision shall not be construed to include maintenance items such as making normally anticipated adjustments or correcting adjustment errors on the part of the Owner's personnel.

D. Provisions of this warranty shall be considered supplementary to warranty provisions under Division 01 General Conditions.

PART 2 - PRODUCTS

2.1 Materials and Equipment

A. Materials and equipment furnished shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.

B. All electronic equipment provided under this scope of work shall be of a make/model that is currently in production at the time of installation.

C. No equipment shall be provided under the scope of this work that has been listed by the manufacturer for End of Life/End of Support.

D. All electrical/technology equipment and wiring shall bear the Underwriters Laboratories, Inc. label where UL labeled items are available, and shall comply with NEC (NFPA-70) and NFPA requirements.

2.2 Reference Standards

A. Where standards (NFPA, NEC, EIA/TIA, ASTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the Authority Having Jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

2.3 Equipment Selection

A. The selection of materials and equipment to be furnished shall be governed by the following:

1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specification, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturers listed.
2. Where the words "or approved equal" appear after a manufacturer's name, specific approval must be obtained from the Engineer during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval.

B. Substitute equipment of equal quality and capacity will be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.

2.4 Shop Drawings

A. All shop drawings shall be submitted in groupings of similar and/or related items (cable and connectors, equipment cabinets and racks, etc.). Incomplete information will cause the submittal to be rejected and will require resubmittal before approval.

B. Submit for approval all applicable telecommunications systems prior to any equipment/materials being purchased or installed. These items are referred to by symbolic designation on the drawings and specifications. All submittal line items represented on the drawings should have matching product (make/model/etc.) information. Refer to other sections for equipment specification requirements. Submittals are required for the following:

1. Copper & fiber structured cabling, system components, & fire rated sleeves
2. Structured cable system raceways and supports.
3. Equipment racks and cabinets including wire / fiber management components.
4. Label copper patch panels & fiber LIU equipment.
5. Telecommunication room equipment rack, cable tray & armored cable grounding components.
6. Conduit, inner duct, junction and pull boxes.
7. Surface raceway components
8. Telecommunication room telephone system components
9. Data network system components
10. Audio/video cabling, system components, rack elevation diagrams & FSR Box size and contents required.
11. Access control system components.
12. Security Camera system components.
13. Riser Diagram and Sleeves.

C. The review of shop drawings by the Architect or Engineer shall not relieve the Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.

2.5 Network Enabled Devices with username/password

A. All devices which include a username/password shall be set by the contractor during construction as directed by the owner.

B. Devices shall not be left at default unless specifically directed by the owner.

C. Turn over a spreadsheet with all devices including device description, MAC address, IP address (if static) username and password.

PART 3 - EXECUTION

3.1 Design Validation

A. The bidding, shop drawing submittal, procurement of materials, the installation as-builts and record documents shall be reviewed and overseen by the RCDD(s) assigned to the project.

B. The Contractor's bid, shop drawing submittals, as-builts and record documents shall bear the valid seal of the RCDD(s) assigned to this project.

C. All calculations, shop drawings, testing, certification and as-built documents shall be directly supervised by the RCDD assigned to the project.

D. A sub-contractor must provide the general contractor a copy of the manufacturer's certification that the sub-contractor is currently certified to install, test and warranty the proposed system prior to a bid submittal. See Section 27110, 7.5A and section 27010, 1.16A. The owner reserves the right to have the non-certified sub-contractor removed from the job.

3.2 Work in Existing Buildings / Demolition

A. All demolition of existing telecommunications cable, equipment and materials shall be specified by C&IT and done by this contractor unless otherwise indicated. Include all items such as, but not limited to, cable, patch panels, devices, and wiring back to the source, called out on the drawings and as necessary whether such items are indicated on the drawings or not to meet NFPA requirements.

B. In general, demolition of old low voltage telecommunications cabling work is indicated on the drawings, however, the contractor shall visit the job site to determine the full extent and character of this work. All existing voice and data jacks demolished need to be documented. A room number, jack number, approximate location in the room and the telecommunication room where it is terminated needs to be identified. This information must be returned to C&IT IOPS Networking Engineering Group, project management & the plant manager. If a contractor cuts and or damages a live network cable by mistake it is the responsibility of the contractor to replace the cable to its original working condition as quickly as possible.

C. None of the recovered material shall be reused in the new work.

D. Where new walls and/or floors are installed which interfere with existing telecommunications outlets, devices, etc., this contractor shall adjust, extend and reconnect such items as required to maintain continuity of same.

E. Adequately protect and preserve all existing and newly installed work. Promptly repair any damage to same condition at this the contractor's expense.

F. Consult with the owner's Project Coordinator and C&IT Project Coordinator as to the methods of carrying on the work so as not to interfere with the owner's operation any more than absolutely necessary. Accordingly, all telecommunications services shall be kept in operation as long as possible, and the services shall only be interrupted at such time as will be designated by the owner's representative.

G. Where interruption of service cannot be avoided, C&IT must have prior notice no less than five (5) business days to assess impact and inform users of the work.

3.3 Owner Furnished Contractor Installed Equipment

A. All indoor rated Access Points shall be below ceiling, mounted in a downward-facing orientation. All wireless access points mounted to a drop ceiling infrastructure are to be secured to a solid support within or above the tile system using a BICSI or NEC approved method. No direct mounting to ceiling tiles will be permitted. Exceptions to this must be authorized by C&IT Wireless Engineering.

B. Hard ceiling mounted wireless Access Points are to be mounted to a square 4”x4” deep gang box. No round light fixture gang boxes. No round mud rings allowed.

C. ALL wireless Access Points located in Open or Exposed Ceiling Concept areas, must be mounted to a threaded rod or conduit mount to the unistrut, and located below any mechanicals, pipes, ducts, at a height of no less that 10ft, and no higher than 15ft from the floor.

D. All Access Points will be mounted with product mounting brackets approved by the wireless vendor.

E. Typical mounted Access Point height shall be between 8 to 10 ft AFF. Exception to this is only authorized by C&IT Wireless Engineering or if it is not possible due to an extended height ceiling.

F. Terminate the access point jack on the auxiliary systems patch panel in the rack, not in the data panel.

G. All wireless horizontal cabling shall be labeled by access point location naming convention, not by jack number. (EX: WAP-H### or WAP-Rm### or Outdoor EX: WAP-O-location)

H. Provide cable and connectors only from WSU-preferred manufacturers list.

I. Provide two grey patch cords per wireless outlet installed.

J. Patch cord length shall be consistent with installed wired network installation and design per wireless outlet jack installed.

K. Provide a 15-foot cable slack loop in the ceiling or as close as possible to the jack location end.

L. All cable installed, patch cords, jacks and patch panels must be same manufacturer and product series.

M. Access point mounting and patch cord security will be identified on a case-by-case basis in the C&IT Wireless Engineering access point design.

N. Access point procurement, configuration and labeling will be done by C&IT Wireless Engineering. This ensures inventory control and prevents duplicate location deployment.

O. Installation of access points will be in the low voltage telecommunications cabling contractors' scope of work.

P. Data activations for the access points (patch panel cross connect to the network switch) will be done by C&IT Network Engineering.

3.4 Testing

A. As each wiring system is completed, it shall be tested for continuity and freedom from grounds.

B. As each electrically operated system is energized, it shall be tested for function.

C. The Contractor shall perform megger and resistance tests and special tests on any circuits or equipment when an authorized inspection agency suspects the system's integrity or when requested by the Architect or Engineer.

D. All signaling and communications systems shall be inspected and tested by a qualified representative of the manufacturer or equipment vendor. Refer to specific sections for required testing of the various systems. Submit four (4) copies of reports indicating results.

E. Tests shall be witnessed by field representatives of the Architect or Engineer or shall be monitored by a recorder. Furnish a written record of each system test indicating date, system, test conditions, duration and results of tests. Copies of all test reports shall be included in the O&M manuals.

F. Instruments required for tests shall be furnished by the Contractor.

3.5 Equipment Cleaning

A. No fixed item of active AV/Network/Security electronic equipment shall be installed in any areas where active construction is generating significant amounts of dust/debris (drywall finishing, concrete sanding, wall painting, etc.). It shall be the responsibility of this contractor to fully coordinate the activity of the general trades contractors with regards to floor/wall/ceiling

finishing work to assure that active AV/Network/Security equipment is not exposed to or damaged by the materials and debris generated by these and similar activities.

B. No fixed item of passive AV/Network/Security equipment (such as cabling, faceplates, jacks, etc.) shall be installed in any areas prior to substantial completion of floor/wall/ceiling installation and finishing where the installation of such equipment will expose it to damage or defacement from those general trades activities. This contractor shall be fully responsible to fully protect/isolate any installed equipment from damage/defacements from the installation of or application of materials and finishes associated with the General Trades Work.

C. This contractor shall be responsible for fully protecting all equipment and providing final cleaning to restore equipment to its original pre-installation condition prior to project completion and turn-over to owner.

D. Refer to appropriate Sections for cleaning of other equipment and systems for normal operation.

E. Newly installed network equipment shall be protected from theft, dust or damage while construction is going on.

F. Protect conduit openings with temporary plugs or caps.

G. Locks must be installed on telecommunication room doors prior to any equipment installation.

3.6 Operation and Adjustment of Equipment

A. As each system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing and adjusting voltages and currents; verifying phase rotation; setting breakers, ground fault and other relays, controllers, meters and timers; and adjusting all operating equipment.

3.7 Operating Demonstration and Instructions

A. Set the various systems into operation and demonstrate to the Owner Engineer / Construction Manager that the systems function properly and that the requirements of the Contract are fulfilled.

B. Provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.

C. O & M Manuals shall be submitted, reviewed and approved prior to scheduling of demonstrations.

D. A minimum of 24 hours shall be allowed for instruction to personnel selected by the Owner. Instructions shall include not less than the following:

1. Show location of items of equipment and their purpose.
2. Review binder containing instructions and equipment and systems data.

3. Coordinate written and verbal instructions so that each is understood by personnel.
4. Manufacturer's representatives for the various special and communication systems shall give separate instructions.
5. All operating demonstrations and instructions for each system shall be audio/video digitally recorded and turned over to the Owner.

E. A minimum of 48 hours continuous trouble-free operating time shall be acceptable to prove that the systems function properly.

F. Note that additional time for training, operating time, etc. may be required per other specification sections and shall be included. This section only establishes minimum requirements.

END OF SECTION

SECTION 27 05 02
AGREEMENT AND WAIVER FOR USE OF ELECTRONIC FILES

PART 1 - GENERAL

1.1 The Engineer, at his sole discretion and without obligation, makes graphic portions of the contract documents available for use by the contractor in electronic format. These electronic files are proprietary and remain the Engineer's Instruments of Service and shall be for use solely with respect to this project, as provided in the Standard Form of Agreement between Owner/Architect and Engineer.

1.2 Electronic files shall be released only after bids have been received for the project and contracts have been signed with the contractors.

1.3 The contractor shall acknowledge receipt of electronic files in the requested format for this project. The electronic files are provided as a convenience to the User, for use in preparing shop drawings and/or coordination drawings related to the construction of only the project identified in the Agreement. The electronic files and the information contained within are the property of the Engineer and/or the Architect and/or the Owner and may not be reproduced or used in any format except in conjunction with the project identified in the Agreement.

1.4 The User acknowledges that the information provided in the electronic files is not a substitution or replacement for the Contract Documents and does not become a Contract Document. The User acknowledges that neither the Engineer, the Architect, the Consultants, the Client or the Owner make any warrant or representation that the information contained in the electronic files reflect the Contract Documents in their entirety. The User assumes full responsibility in the use of the electronic files, including the responsibility to see that all manual modifications, addenda, bulletins, clarifications and Change Orders to the drawings executed as a part of the Contract Documents have been incorporated.

1.5 The User acknowledges that the receipt of electronic files in no way relieves the User from the responsibility for the preparation of shop drawings or other schedules as set forth in the Contract between the Contractor and the Owner.

1.6 Electronic files are available in the Revit model format for a cost as indicated in the Agreement and Waiver Form. Providing the documents in the .DXF format will be an additional charge per sheet as indicated in the Agreement and Waiver Form. Charges are for the Engineer's time to prepare the documents in the format stated. They are available through the Engineer's office on a C.O.D. basis only. A sample of the format will be provided by the Engineer upon request by the contractor, for the purpose of testing the compatibility of the format to contractor's systems.

1.7 Projects developed using AutoCAD MEP will have all drawings converted to the AutoCAD format, when requested to be DWG or DXF format.

1.8 Project models will be furnished without views.

1.9 The electronic files shall be stripped of the Project's name and address, the Architect's / and / Engineer's / and / any consultant's name and address, and any professional licenses indicated on the contract documents, (and all dimensions, verbiage, and statistical information). Use of these

electronic files is solely at the contractor's risk, and shall in no way alter the contractor's Contract for Construction.

1.10 The User agrees to indemnify, hold harmless and defend the Engineer, the Architect, the Consultants, the Owner, the Client and any of their agents from any litigation resulting from the use of (by any means of reproduction or electronic media) these files. The Engineer makes no representation regarding fitness for any particular purpose, or suitability for use with any software or hardware, and shall not be responsible or liable for errors, defects, inexactitudes, or anomalies in the data, information, or documents (including drawings and specifications) caused by the Engineer's or its consultant's computer software or hardware defects or errors; the Engineer's or its consultant's electronic or disk transmittal of data, information or documents; or the Engineer's or its consultant's reformatting or automated conversion of data, information or documents electronically or disk transmitted from the Engineer's consultants to the Engineer.

1.11 The contractor waives all claims against the Engineer, its employees, officers and consultants for any and all damages, losses, or expenses the contractor incurs from such defects or errors in the electronic files. Furthermore, the contractor shall indemnify, defend, and hold harmless the Engineer, and its consultants together with their respective employees and officers, harmless from and against any claims, suits, demands, causes of action, losses, damages or expenses (including all attorney's fees and litigation expenses) attributed to errors or defects in data, information or documents, including drawings and specifications, resulting from the contractor's distribution of electronic files to other contractors, persons, or entities.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 Attached "Agreement" shall be submitted with accompanying payment to the Engineer prior to delivery of electronic files.

END OF SECTION

HEAPY

SECTION 27 05 02A
ELECTRONIC FILES HEAPY RELEASE FORM TO CONTRACTORS

Project: WSU College of Nursing Renovations

Owner: Wayne State University

Heapy Engineering Project Number: 2024-91003

Heapy Engineering Project Manager: Phil Boles

The Provider, named below, will furnish the Recipient, named below, certain documents prepared by the Provider or its sub consultants in an electronic format. These documents are hereinafter **collectively** referred to as "Electronic Files". The Electronic Files are instruments of the Provider services performed solely for the Owner's benefit and to be used solely for this Project. The Provider does not represent that the information contained in the Electronic Files are suitable for use on any other project or for any other purpose. If the Electronic Files are used for any other project or purpose without the Provider's specific written permission, the risk of such use shall be assumed solely by the Recipient or other user.

Prior to the use of the Electronic Files the Provider and the Recipient agree to the following terms and conditions:

1. The Provider and Recipient fully understand that the data contained in these electronic files are part of the Provider’s Instruments of Service. The Provider shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

2. The Recipient confirms their request to the Provider for Electronic Files for the Project listed above, which the Recipient understands are to be provided only in accordance with, and conditioned upon, the terms and conditions of this Agreement and Waiver for Use of Electronic Files.

3. The Provider agrees that the Recipient may use the Electronic Files for the sole purpose of preparing shop drawings and/or coordination drawings for the above Project only. Any Electronic Files provided are strictly for the use of the Recipient in regard to the Project named above and shall not be utilized for any other purpose or provided by the Recipient to any entity other than its subcontractors for the Project named above.

4. The Recipient acknowledges that the furnishing of Electronic Files in no way relieves the Recipient from the responsibility of shop drawings or other schedules as set forth in the Contract between the Contractor and the Owner.

5. The Recipient acknowledges:

a. That the Electronic Files do not contain all of the information of the Bid Documents or Contract Documents for the construction of the Project above.

b. That information in the Bid Documents or Contract Documents may be revised or modified in the future.

c. The Provider does not have, and will not have, any duty or obligation to advise or give notice to the Recipient of any such revisions or modifications.

d. That the Recipient agrees that its use of the Electronic Files is at the Recipient's sole risk of liability, and that the Recipient shall make no claim or demand of any kind against the Provider arising out of Recipient's receipt or use of the Electronic Files.

6. The Provider makes no representation or warranty of any kind, express or implied, with respect to the Electronic Files and specifically makes no warranty that the Electronic Files shall be merchantable or fit for any particular purpose, or accurate or complete. Furthermore, any description of said Electronic Files shall not be deemed to create an implied or express warranty that such Electronic Files shall conform to said description.

7. Due to the unsecured nature of the Electronic Files and the inability of the Provider or the Recipient to establish controls over their use, the Provider assumes no responsibility for any consequences arising out of the use of the data. It is the sole responsibility of the Recipient to check the validity of all information contained within the Electronic Files. The Recipient shall at all times refer to the Construction Documents of the project during all phases of the project. The Recipient shall assume all risks and liabilities resulting from the use of this data, and the Recipient agree(s) to waive any and all claims and liability against the Provider and its sub consultants resulting in any way from the use of the Electronic Files.

8. Electronic Files are provided strictly as a courtesy by the Provider solely for the convenience of the Recipient and are not part of the Bid Documents or Contract Documents for the Project. The Electronic Files do not replace or supplement the paper copies of any drawings, specifications, or other documents included in the Contract Documents for use on the project.

    a. The Recipient assumes full responsibility in the use of Electronic Files, including the responsibility to see that all manual modifications, addenda, bulletins, clarifications and Change Orders to the drawings executed as a part of the Contract Documents have been incorporated.

9. As stated herein, the possibility exists that the Electronic Files provided may differ from the Bid Documents or Contract Documents for construction of the Project. The Provider shall not be responsible, nor be held responsible, for differences between Electronic Files, the Bid Documents, and Contract Documents. The Bid Documents or Contract Documents for the Project may be modified by the Provider at any time, either before or after construction begins. The Provider has no responsibility, either before or after any such modification, to determine or to advise the Recipient whether any such modification causes Electronic Files provided to the Recipient to be out of date, inconsistent with the Bid Documents or Contract Documents, or otherwise unsuitable or unfit for use in any way.

10. The Recipient assumes all risk and liability for any losses, damages, claims, or expenses (including defense and attorney fees) resulting from its receipt, use, or possession of Electronic Files furnished by the Provider. The Provider makes no representation, warranty or guarantee that the Electronic Files:

    a. Are suitable for any other usage or purpose.

b. Have any particular durability.

c. Will not damage or impair the Recipient's computer or software.

d. Contain no errors or mechanical flaws or other discrepancies that may render them unsuitable for the purpose intended by the Recipient.

11. Recipient agrees to indemnify, defend and hold harmless the Provider, agents, employees, and the Owner from, and against, any and all claims, suits, losses, damages or costs, of any kind or nature, including attorney's fees, arising from or by reason of the Recipient's use of Electronic Files provided by the Provider, and such defense and indemnification obligation duties shall survive any use under this Agreement and Waiver for Use of Electronic Files.

12. The Recipient agrees that the Provider shall have no responsibility whatsoever for problems of any nature arising from transmitting and storing electronic files at a Recipient requested FTP or project management site or the conversion of the Electronic Files by the Recipient or others for use in non-native applications. The Provider will not provide Electronic Files in compressed formats. Recipient agrees to accept the files in the format provided by the Provider, and that Recipient's conversion or electronic file storage at the Recipient's requested site, shall be at Recipient's sole risk.

13. Recipient acknowledges:

    a. That the Electronic Files provided by the Provider are a graphical representation of the building in order to generate two-dimensional industry standard drawings.

    b. That the data contained in the Electronic Files may not be 100% accurate and should not be used for dimensional control, building layout, shop drawings, or any other similar purpose

    c. That any schedule of materials produced directly from the Electronic Files has not been checked for accuracy.

    d. That the information in the Electronic Files should be used only for comparative purposes and shall not be relied upon for accurate quantity estimates or used in establishing pricing.

14. Electronic Files provided by the Provider will only contain elements and content that the Provider deems necessary and appropriate to share. No specific Level of Detail (LoD) is implied or expected. The Recipient agrees that no proprietary content, MvParts or Revit Families or any other AutoCAD MEP or Revit MEP content shall be removed from the model and/or used for any other purpose but to support this specific project.

15. The Provider, at its sole discretion, may modify the Electronic files before they are provided to the Recipient. Such modifications may include, but are not necessarily limited to, removal of certain information. The Provider, at its sole discretion, may refuse to provide some or all Electronic Files requested by Recipient.

16. The availability of Electronic Files that were not prepared by the Provider is subject to the consent of the Owner or consultant that prepared those Electronic Files. The Provider will not negotiate with the Owner or consultant or repeatedly solicit the Owner or consultant to obtain such consent. Neither this Agreement and Waiver for Use of Electronic Files nor any such separate Consultant's consent may be assigned or transferred by Recipient to any other person or entity.

Provider (Name of Company): _____

Recipient (Name of Company): _____

Recipient Address: _____

Name of authorized Recipient Representative: _____

Title of authorized Recipient Representative: _____

E-mail address of authorized Recipient Representative: _____

Signature of authorized Recipient Representative: _____

Date: _____

NOTE: Select requested Electronic File format and complete applicable cost summary.

1. ☐ DWG / DXF Format - List of Drawings Requested: _____
_____

2. ☐ Revit Project Model Requested (Model only, no Views included)

The following costs are applicable to Delivery of Electronic Files (select one):
☐ CD-ROM ☐ Heapy FTP ☐ User's FTP site ☐ Flash Drive

Requested Electronic DWG / DXF file format (select one):

☐ 2010 DWG ☐ 2007 DWG ☐ 2004 DWG ☐ 2000 DWG ☐ R12 DWG
☐ 2010 DXF ☐ 2007 DXF ☐ 2004 DXF ☐ 2000 DXF ☐ R12 DXF

Cost of Preparation of Division 27 Electronic DWG / DXF Files:

First Drawing: $50.00			$50.00
Additional Drawings $15.00 each	_____ x $15.00	=	$ _____
Conversion to DXF Format: $5.00 additional/sheet	_____ x $ 5.00	=	$ _____

Total Cost: (Please make check payable to Heapy Engineering and include a copy of this form.) $ _____

All files will be bound together.

Requested electronic Revit file format (Select One):
☐ 2023 RVT

Cost of Preparation of Division 27 Electronic Revit Model Files:

Revit Project Model without Views	$500.00

Total Cost: (Please make check payable to Heapy Engineering and include a copy of this form.) $ _____

SECTION 27 05 04
BASIC COMMUNICATIONS MATERIALS AND METHODS

PART 1 - GENERAL

1.1 Refer to Section 26 05 04 Basic Electrical Materials and Methods which are hereby made part of Division 27 - Communications.

1.2 Continuity of Service

A. Work shall be so planned and executed as to provide reasonable continuous service of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration or switch over, the Owner and Construction Manager shall be notified in advance and outages scheduled at the Owner's reasonable convenience.

B. Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline must include tentative dates, times of day for disruption, downtime and restoration of services. Submit the outline sufficiently in advance of the proposed work to allow the Architect or Engineer and Construction Manager to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.

C. Shutdown of systems and work undertaken during shutdowns shall be bid as being done during normal working hours. If the Owner should require such work be performed outside of normal working hours, reimbursement shall be made for premium time expenses only, without mark up.

PART 2 - PRODUCTS

2.1 Access Panels

A. Provide ceiling and wall access panels where indicated on the drawings, or where otherwise required to gain access to concealed junction boxes, pull boxes, devices and equipment requiring service or adjustment.

B. Access panels shall be 18 inch x 18 inch size unless larger panels are shown or required. Mounting frames shall be compatible with the material in which they are installed. Access panels shall be:

1. Standard flush type with overlapping flange for masonry and tile walls.
2. Standard flush type for drywall ceilings and walls, Milcor style “M” or equal.

C. Access panels in drywall ceilings shall be glass reinforced gypsum drywall lay-in panels with flush mounting frames. Corners of panels shall be rounded. Panels shall be 18 inches x 18 inches unless larger panels are shown or required.

D. Access panels in fire rated shaft walls and in fire rated ceilings shall be "B" label or greater to match the rating of the wall or ceiling.

E. Materials used in plenums shall be rated for plenum use conforming to the ASTM E84 25/50 smoke development and flame spread restrictions.

PART 3 - EXECUTION

3.1 Workmanship

A. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Architect and Engineer shall have the right to stop the work if highest quality workmanship is not maintained.

B. Electrical work shall be performed by a licensed Contractor in accordance with requirements of the jurisdiction.

C. Communication work shall be performed by certified Contractor in accordance with the respective specification and system requirements.

3.2 Protection

A. The Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Architect or Construction Manager.

B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide drop cloths and visqueen or similar barriers where dust and debris is generated, to protect adjacent areas.

3.3 Cutting and Patching Projects with Remodeling

A. Refer to Division 01 - General Requirements for information regarding cutting and patching.

B. Plan the work well ahead of the general construction. Where conduits, wireways and cable trays are to pass thru new walls, partitions, floors, roof or ceilings, place sleeves in these elements or arrange with the General Contractor to provide openings where sleeves are not practical. Where sleeves or openings have not been installed, cut holes and patch as required for the installation of this work, or pay other trades for doing this work when so directed by the Architect or Construction Manager. Any damage caused to the building shall be repaired or rectified.

C. Where conduits, wireways and cable trays are to pass thru, above or behind existing walls, partitions, floors, roof or ceiling, cutting, patching, refinishing and painting of same shall be included in this contract. Core drilling and saw cutting shall be utilized where practical. Contractor to examine where floors and walls, etc. are to be cut for presence of existing utilities.

D. When cutting or core-drilling floor verify location of existing electrical, plumbing or steel reinforcement. Use X-ray method to verify existence of obstructions. Either re-route existing system brace floor or alter location of new work to maintain existing system.

E. All sleeves and openings not used or partially used shall be closed to prevent passage of fire or smoke.

F. All materials, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades, and shall be completed by skilled workmen normally engaged in these trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Architect. Wall, floor and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.

G. Provide steel angle or channel lintels to span openings which are cut in existing jointed masonry walls where the opening span exceeds 16 inches. Provide framing around roof openings for required support of the roof deck.

H. Engage a Roofing Contractor on a subcontract basis for roofing and roof insulation work necessitated by the Communications work. The Roofing Sub-Contractor shall be certified for installation and repair of the roofing system so as to maintain the existing roofing warranty.

3.4 Removals, Alterations and Reuse Projects With Remodeling

A. Refer to the drawings for the scope of remodeling in the existing building.

B. Cooperate with the General Contractor and Construction Manager regarding all removal and remodeling work. The Contractor shall remove existing work which is associated with his trade, and which will be superfluous when the new system is installed and made operational. Void unused conduit behind walls or below floors as necessary or as directed. No wire or conduit shall be removed which will impair the functioning of the remaining work unless first replaced with a rerouted section of wire or conduit to ensure continuity. Remove inactive wiring back to the last active junction box, panelboard or piece of equipment.

C. Upon completion, no unused conduit or stub shall extend thru floors, walls or ceilings in finished areas. Abandoned conduit where remaining in place shall have any unused wiring removed. All accessible unused conduit shall be removed.

D. When it is necessary to reroute a section of an active circuit, the rerouted section shall be installed before removing the existing in order to minimize system down time. Rerouted sections shall be installed as required for new work.

E. Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Turn over to the Owner and place where directed on the premises all removed material and equipment so designated by the Owner. All material and equipment not claimed by the Owner shall become the property of the Contractor responsible for removal and shall be removed from the premises.

F. Remove, store and reinstall lay-in ceiling tile and grid as needed to perform work in areas where such removal and re-installation is not to be done by the General Contractor. Damaged tile and/or grid shall be replaced with new matching tile and/or grid.

G. In areas of minor work where the space is not completely vacated, temporarily move portable equipment and furnishings within the space as required to complete the work. Coordinate this activity with Owner. Protect the Owner's property by providing dust covers and temporary plastic film barriers to contain dust. Remove barriers and return equipment and furniture upon completion of the work.

H. Refinish any surface disturbed under this work to match existing, except where refinishing of that surface is included under another Contract.

3.5 Painting

A. Finish painting is included in the General Contract except where otherwise required under remodeling work. Refer to the Cutting and Patching paragraph in this Section for finishing requirements.

3.6 Access Panels

A. Install access panels or pay general trade to do so. Final appearance is subject to approval by the Architect or Engineer.

B. Location of access panels shall be planned to clear ceiling lights, ceiling support grids and other obstructions so as to allow, wherever possible, full shoulder clearance beside the device to be inspected, adjusted or repaired.

C. Panels with recessed doors are to be fitted with insert panels of drywall. Caution the Installing Contractor to provide appropriate framing with drywall beading to ensure a finished appearance. Shim strips may be required to bring the insert panel flush with the plane of the door and wall / ceiling.

3.7 Backboards

A. Where shown on the drawings on walls in the TR. Backboards shall be provided for wall mounting of communications equipment.

B. General

1. Backboard shall be 0.75 inch thick waterproof flame retardant plywood secured to structure.
2. Communication backboards shall be normally 4 foot x 8 foot mounted 6 inches above floor. Where other sizes are required, they will be noted on the drawings.

END OF SECTION

27 05 05
FIRESTOPPING

PART 1 - GENERAL

1.1 Firestopping assemblies shall be provided at penetrations of conduits, bus ducts, cables, cable trays and other electrical items thru fire rated floors, fire rated floor-ceiling and roof ceiling assemblies, fire rated walls and partitions and fire rated shaft walls and partitions. In addition, firestopping assemblies shall be provided at penetrations thru 0-hour rated floors. Refer to the drawings for fire rated building elements.

1.2 All existing penetrations which have firestopping which are disturbed as part of this project, shall have the existing firestop restored to its UL listed approved condition.

1.3 Firestopping assemblies shall be tested and rated in accordance with ASTM E814, E119 and listed in accordance with UL 1479, as published in the UL Fire Resistance Directory. Firestopping shall provide a fire rating equal to that of the construction being penetrated.

1.4 Firestopping materials, assemblies and installation shall conform to requirements of the Authority Having Jurisdiction.

1.5 For those firestopping applications that exist for which no UL tested system is available through any manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council.

1.6 Shop drawings shall be prepared and submitted for review and approval. Submittals shall include manufacturer's specifications and technical data of each material, documentation of U.L. firestopping assemblies and installation instructions.

PART 2 - PRODUCTS

2.1 Sleeves shall be used in standard walls and floors with no fire rating. All sleeves through the floor are to extend 4 inches above floor, unless otherwise noted. Provide escutcheons at each sleeve in finished areas and adequate spacing between sleeves to accommodate escutcheons.

A. Provide STI Specseal Ready sleeve system (Part # STI FS100, STI FS200, or STI FS400) and install to manufacturer specifications.

2.2 All fire rated walls or floor cores riser systems must use the Hilti CP 653 BA sleeve system.

2.3 Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for fill and damming.

PART 3 - EXECUTION

3.1 Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.

3.2 Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.

END OF SECTION

27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 Scope of Work

A. Work includes the provision of the technical grounding system including connections within technology rooms/closets.

B. Work includes bonding of technology pathways and equipment to the technical grounding system.

1.2 System Description

A. Provide a Telecommunications Ground Bar (TGB) in the TR. Provided under Division 26 Bid Package.

B. Provide a Telecommunications Bonding Conductor (TBC) from each TGB to a local electrical panelboard ground. This bonding conductor shall consist of a minimum #6, bare copper grounding conductor. Provide a warning label attached to each Telecommunications Bonding Conductor at each end stating “WARNING: Building telecommunications grounding system. Do not remove or disconnect without prior approval from building Telecommunications Department.” Provided under Division 26 Bid Package.

C. Provide bonding to all conduit sleeves. Provide bonding to all technology equipment racks and cabinets in the wiring closet.

D. This contract shall be responsible for providing all equipment, conduit and sleeve grounding in the TR to the grounding system installed under Division 26.

E. All work shall be in compliance with NEC, Article 250 and ANSI/TIA -607B.

1.3 Quality Assurance

A. All work shall be installed in compliance with the latest edition of the Commercial Building Telecommunications Wiring Standard EIA/TIA, BICSI Standards, applicable National Electric Code Sections, Michigan Building Codes.

B. All equipment shall be UL listed.

1.4 Shop Drawings

A. A complete list of materials with model and part numbers and references to the Part 2 specification paragraph numbers.

B. Manufacturers Data Sheets of all products and cabling, specific to the project. Data sheets shall show the exact parts, with model numbers and options as required and clearly identified.

1.5 Relevant Standards

A. The Telecommunications Grounding Installation shall comply with the following at a minimum:

1. All local, state and national codes
2. The National Electric Code (NEC)
3. The National Electrical Safety Code (NESC)
4. Electronic Industries Alliance (EIA) / Telecommunications Industry Association (TIA) 606, J-STD-607 and all applicable and current Technical Service Bulletins (TSB).

PART 2 - PRODUCTS

2.1 Telecommunications Ground Bar (TGB)

A. Ground bar shall be solid copper, 4 inches high, .25 inch thick, minimum 12 inches long with pre-drilled holes for standard-sized Lugs and must be UL listed. Provide final length as required to accommodate grounding lug attachments.

B. Ground bars shall be provided with insulated stand-off brackets for wall mounting providing a minimum of 2 inch wall clearance. Insulators shall have a minimum voltage rating of 600V and a minimum Short Time Electrical Strength of 55kVv.

C. All connections shall be made with double-bolted, compression style grounding lugs.

D. Bus bar and standoff assembly manufactured by StormCopper or equal by B-Line, Andrew, Tessco Technologies, Hubbell.

E. All products provided for this project shall meet the “Buy American Act”.

2.2 Telecommunications Bonding Conductor (TBC)

A. Utilized for connections of TMGB to main service building ground, and for TMGB to TGB connections. Sized as required in TIA 607 standards.

B. Insulated Conductors - Soft, annealed bare copper per ASTM B-3. Concentric, compressed stranded (class B or C Alternate ASTmB-787) per ASTM B-8, UL-83 and UL-854. Insulation Jacket: Nylon per UL-83. Insulation: High dielectric polyvinyl chloride per UL-83 and UL-854.

C. Uninsulated Conductor: Soft, annealed bare copper per ASTM B-3. Stranded as specified herein. Overall Finish: Gray polyvinyl chloride (PVC) per UL-824.

D. All connections shall be made with double-bolted, compression style grounding lugs.

E. RATINGS - Cables conform to the following standards:

1. UL-83 for THHN-THWN Cdrs.
2. Federal Specification J-C-30B

2.3 Bonding Conductors

A. Conductor shall be minimum #6AWG and may be either stranded or solid, insulated or bare.

B. Cable as manufactured by Superior/Essex, Rome, AIWC.

C. All connections shall be made with double-bolted, compression style grounding lugs.

2.4 All products provided for this project shall be manufactured in the United States.

PART 3 - EXECUTION

3.1 General

A. The telecommunications grounding system shall provide an electrically continuous, low impedance path for all connected telecommunications equipment and pathways.

B. When using grounding conductors installed in rigid, ferrous metallic conduit, both ends of the bonding conductor must be bonded to the conduit ends.

C. The bonding conductors shall have no splices or connections.

D. The bonding conductor shall be connected to the building main electrical grounding system through the use of exothermic weld, listed lugs, listed pressure connectors, listed clamps, or other listed means.

E. All metallic telecommunications pathways and equipment within telecommunications spaces shall be bonded to the local TGB utilizing Bonding Conductors (BC).

3.2 Wiring

A. Refer to drawings for specific location and arrangement of telecommunications Bonding Backbone and Telecommunications Ground bars.

B. The drawings do not indicate specific routes for telecommunications grounding cables. The Telecommunications Contractor is responsible for developing all cabling routes utilizing existing cable management pathways and systems or providing supplemental cable management pathways and systems so that all structured cabling adhere to specific codes and standards specifically developed for the installation of such cables. Where the use of existing cable management systems and pathways would cause the grounding system to violate specific codes and standards regarding cable lengths, environments, proximity to EMI and RF noise sources, etc, the Telecommunications Contractor shall be responsible for developing alternative pathways and shall include all labor and material for doing so within the scope of this work.

3.3 Grounding/Bonding Connections

A. Ground all backbone cable sheaths, shield drain wires from all voice/data horizontal cable, equipment racks and equipment to the local TGB.

B. All grounding and bonding shall be in conformance with the National Electric Code, article 250 and as recommended by ANSI/TIA-607B.

C. When bonding to painted equipment, methods shall be utilized to ensure continuity of grounding connection.

D. All connection to ground bars (TGB) shall be made using listed lugs appropriate for mounting provisions in the supplied ground bar.

3.4 Testing General

A. The Contractor shall be responsible for testing the complete technology grounding system.

B. No testing shall be executed until the entire system has had the Owner approved labeling scheme applied and accepted.

C. Test reports shall be provided to indicate.

1. Impedance values across the TBC from the TMGB to the main electrical service ground.

D. Tests shall be monitored by a recorder.

E. System testing shall be performed with final test results turned over to the Owner prior to acceptance of the system. Missing or incomplete test results will not be reviewed and the system will not be commissioned by the Owner / Architect / Engineer.

F. Instruments and labor required for tests shall be furnished by the Contractor. All system test equipment shall be approved by the Owner/ Architect / Engineer prior to application.

G. Instruments required for tests shall be furnished by the Contractor.

3.5 Labeling

A. The Contractor shall be responsible for labeling all telecommunications grounding equipment, cable, etc. in accordance with the guidelines as described herein.

B. Each telecommunications ground bar shall be provided with a warning label to read:

1. “WARNING: Building telecommunications grounding system. Do not remove or disconnect without prior approval from building Telecommunications Department.”

C. Each Telecommunications Bonding Conductor (TBC, TBB, GE, etc.) to be provided with a label indicating source and destination ground bars.

3.6 As-Built Documentation

A. Refer to Section 27 05 01 for submittal requirements.

B. Copies of all approved shop drawings with the Engineer's stamp.

C. Copy of all test reports.

D. Technology drawings updated with final as-built information. This shall be in the form of a complete set of Technology drawings with as-built information indicated in colored pen based upon actual field conditions.

1. System schematic and block diagrams for technology grounding system updated with final as-built information. These drawings shall define the exact arrangement of each system including wiring configuration, device locations and cable types.

3.7 Warranty

A. The entire grounding and bonding system as specified herein shall be guaranteed against defects in workmanship and materials for a period of one (1) year as described herein. Period shall commence after system has been commissioned by the Owner, Engineer and Architect. The Installing Contractor shall provide the initial warranty service. Provide a written statement of this warranty as part of the shop drawing submittal and included in the O&M Manuals.

END OF SECTION

SECTION 27 05 28
COMMUNICATIONS SYSTEMS PATHWAYS AND SUPPORT EQUIPMENT

PART 1 - GENERAL

1.1 Scope of Work

A. Work consists of pathways to carry communication wiring of all descriptions, including empty conduits, conduit sleeves, and cable management systems.

B. Work includes support equipment for telecommunications cabling including backboards, rough-in boxes and cabinets.

C. Work includes new cable management systems to support all installed communications cabling per standards and manufacturer's recommendations.

1.2 Quality Assurance

A. Communications pathways and support equipment shall be closely coordinated with other trades to provide adequate access, appropriate clearances and required separation between systems.

1.3 Shop Drawings

A. A complete list of materials with model and part numbers and references to the Part 2 specification paragraph numbers.

B. Manufacturers Data Sheets of all products and cabling, specific to the project. Data sheets shall show the exact parts, with model numbers and options as required and clearly identified.

1.4 Drawings

A. The drawings, which constitute a part of these bid documents, indicate the general route of the pathways to carry communication wiring systems. Data presented on these drawings are as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification, of all dimensions, routing, etc., is directed.

B. Specifications and drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys as part of his work prior to submitting system layout drawings.

1.5 Related Work by Others

A. Communications cabling shall be included as stated in the specification section for each individual system.

PART 2 - PRODUCTS

2.1 Conduit Systems

A. Refer to specification section 27 05 33 Raceway and Boxes for Communications Systems.

2.2 Cable Management System

A. Provide pre-manufactured cable supports as manufactured by Cooper B-Line or Erico-Caddy. Cable supports shall be secured to building structure through threaded rod, beam clamps or other UL approved supports as required by site conditions. Components shall provide minimum 48 inches or maximum 60 inches cable support point spacing.

B. Cable management devices must be sized to accommodate 100 percent spare capacity of the final installed cable base.

C. Cable management system support components shall be designed with wide support surfaces that do not cause cables to be bend, crushed or otherwise deformed when installed within component loading parameters. Cable management system shall meet UL standards and be UL labeled. Utilizing elements of the building's structure such as beams, joists, etc. to hang cable from will not be acceptable.

D. Bridle rings without saddles shall not be acceptable.

E. All J-hooks shall be supported directly from the structure above or wall mounted, as applicable, independent of ceiling framing, electrical conduit, mechanical piping and ductwork. Provide allthread rod with ¼" diameter or equivalent supporting means with suitable fasteners when attaching to structure or structural members. Increase size of support as required when multiple J-hooks (stacked or tree configuration is used) are attached to single support based on maximum loading capacity of J-hooks.

2.3 Backboards

A. Refer to Section 27 05 04 – Basic Communications Materials and Methods.

2.4 Rough-In Boxes

A. Refer to Section 27 05 33 – Raceway and Boxes for Communications Systems.

B. Refer to drawings for types, quantities and configurations of outlet boxes used to serve communications cabling.

2.5 All products provided for this project shall be manufactured in the United States.

PART 3 - EXECUTION

3.1 General Installation

A. Refer to drawings for pathway types, locations and routing.

B. Cable pathways shall provide the following minimum clearances:

1. Motors and transformers – 4 ft.
2. Conduit and cable used for electrical power distribution – 1 ft.
3. Fluorescent lighting – 5 inches.
4. Power lines up to 5 kV – 5 inches.
5. Power lines over 5 kV. – 24 inches.

C. Backboards and cabinets shall be installed in telecommunications rooms/spaces to support telecommunications equipment and wiring. Coordinate locations of backboards and cabinets with Owner prior to installation.

D. Restore fire rating and smoke stoppage integrity where all wireways and raceways pierce walls, floors and ceilings by sealing with approved means; refer to 27 05 33 Raceway and Boxes for Communications Systems paragraph.

E. Provide necessary pathways in areas that have exposed structure or plastered ceilings to provide a wiring path for cables from area above suspended ceilings to respective backboards.

F. No non-metallic or combustible materials shall be installed in ceiling or other plenums used for circulating room air used for heating, ventilation or cooling.

G. Cabling pathways shall be installed with a minimum of 12” clearance to the side, 6” clearance above and 6” clearance below. It shall not be acceptable for any other building systems including piping, ductwork, equipment, etc. to infringe upon this clear space.

3.2 Conduit Systems – Coordinate with Division 26 Contractor to ensure that conduit system installed for telecommunications cabling shall conform to the following:

A. No section of conduit shall be longer than 100 feet between pulling points.

B. No more than two 90 deg. bends in a section of conduit between pulling points.

C. Pulling points/pullboxes shall not be used to change direction of the conduit pathway. Pulling points/pullboxes shall be placed “in-line” with the conduit pathway.

D. Each section of conduit shall be labeled for length, destination closet and origination closet.

E. Refer to EIA/TIA 569-A for specific conduit and pull box requirements.

F. Conduit and wiring above accessible ceilings shall be run as high as possible, above piping and ductwork, so as to not interfere with mechanical trades, access to mechanical and electrical devices and to allow freedom to remove ceiling panels.

G. Provide a No. 12 gauge pull wire or nylon pull cord in each empty conduit run.

3.3 Wireways

A. Wireways shall be supported with factory made hangers designed expressly for this purpose and 0.375 inch diameter solid hanger rods approximately 5 ft. on center or approved strap hangers for surface mounting.

3.4 Cable Management System

A. The drawings do not indicate specific routes for telecommunications cables. The Division 27 Contractor is responsible for developing all cabling routes utilizing existing cable management pathways and systems or providing supplemental management pathways and systems so that all structured cabling adhere to specific codes and standards specifically developed for the installation of such cables. Where the use of existing cable management systems and pathways would cause the structured cable system to violate specific codes and standards regarding cable lengths, environments, proximity to EMI and RF noise sources, etc., the Division 27 Contractor shall be responsible for developing alternative pathways and shall include all labor and material for doing so within the scope of this work.

B. In areas where there is not an installed raceway system (conduits) and a cable support system is required, this contract shall be responsible for providing a cable management system. Where cables are installed open wired through the use of cable management systems, they shall be installed such that there is a minimum sag of 4 inches for every 4 foot of horizontal run. Cable pathways shall provide the following minimum clearances:

1. Motors and transformers – 4 feet.
2. Conduit and cable use for electrical power distribution – 1 feet.
3. Fluorescent lighting – 5 inch.
4. Power lines up to 2kVA – 5 inch.
5. Power lines over 5kVA – 24 inch cable management system shall be secured to building structure utilizing manufactured approved methods and hardware.

C. Cable management system support components shall be designed with wide support surfaces that do not cause cables to be bent, crushed or otherwise deformed when installed within component loading parameters. Cable management system shall meet UL standards and be UL labeled. Utilizing elements of the building's structure such as beams, joists, etc. to hang cable from will not be acceptable.

3.5 Identification / Labeling

A. All continuous communications pathways such as conduit, etc., shall be labeled to indicate origination and destination. Label shall be applied every 50 feet wherever accessible or subject to administration. Coordinate label information with Owner.

B. Label shall consist of mechanically printed, permanent adhesive label, applied to cleaned / prepped area of raceway.

3.6 As-Built Documentation

A. Provide a complete set of architectural floor plan drawings indicating final communications pathway systems with accurate “as-built” locations to show the actual route for the communications systems pathways.

B. Drawings shall indicate each pathway type and provide sizing information such as conduit/innerduct diameter, cable management J-Hook size, etc.

C. Component Service Manuals: Include information for testing, repair, troubleshooting, assembly, disassembly, and required / recommended maintenance intervals for all types of pathways.

3.7 Restore fire rating and smoke stoppage integrity where all wireways and raceways pierce walls, floors and ceilings by sealing with approved means. Refer to Raceway and Boxes for Communications Systems Section 27 05 33.

END OF SECTION

27 05 33
RACEWAY AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 This specification section covers common conduit systems, boxes, firestopping and sleeves. Where other methods are specified under separate sections for specific applications, the specific application requirements shall govern.

1.2 Refer to Section 27 05 05 Firestopping and Division 07 for firestopping requirements.

1.3 Refer to Section 27 05 28 Communications Systems Pathways and Support Equipment.

PART 2 - PRODUCTS

2.1 Conduit Type - Application (Use only conduit types listed)

A. Conduit - Rigid or Intermediate Grade Galvanized Threaded.
Application - restrictions - (Not to be used in):

1. Direct buried in corrosive soils.
2. Corrosive atmospheres.

B. Conduit - Thinwall EMT.
Application - restrictions - (Not to be used in):

1. Poured concrete.
2. Exposed to weather.
3. Underground.
4. Exposed in mechanical equipment or other equipment/process rooms below 48 inches.
5. Hazardous or corrosive atmospheres.
6. Not to be used for medium voltage (2001 volts or higher) cable.
7. Not to be used in utility tunnels.

C. Conduit - Flexible Metal (Greenfield type), galvanized steel or aluminum.
Application - use limited to:

1. Narrow movable partitions where other raceways are not practicable, when approved by the Architect or Engineer.
2. In existing walls for remodel projects, vertical drops to outlets and switches; no more than 3 ft. out the top of the wall.

D. Conduit – Liquid-Tight Flexible Metal.
Application - use and limitations:

1. Connections to all motors, except in air stream or plenum.
2. Connections to controls on dynamic equipment, transformers, etc., outdoors and indoors in wet locations.
3. Use not permitted underground or where subject to physical damage.

E. Plastic jacketed rigid steel conduit shall be used in corrosive atmospheres including swimming pool areas, pool equipment rooms, chlorine storage areas, etc.

2.2 Conduit sizes

A. Conduits shall be 1 inch minimum size.

2.3 Conduit Fittings

A. Fittings and workmanship shall ensure electrical continuity. All conduit systems in poured concrete shall be concrete tight.

B. Application of bushings, locknuts and insulated fittings shall comply with NEC requirements.

C. Use conduit fittings as manufactured by Efcor, Steel City, Raco, Midwest, Appleton, ETP / O-Z / Gedney or T&B, equal to the following catalog numbers:

1. Rigid conduit
   - all fittings, couplings and connectors shall be threaded type.
   - grounding bushings, malleable iron; insulated; Steel City BG-801; Midwest Series GLL.
2. EMT
   - fittings shall be all steel, set screw or compression type, concrete tight.
   - set-screw type couplings; Midwest Series 460; Steel City TK 121; Appleton TW 50S.
   - compression type couplings; Midwest series 660S; Steel City TK111; Appleton TWC50CS.
   - set-screw type connectors; Midwest Series 450; Steel City TC 121; Appleton TWC 50S.
   - compression type connectors; Midwest Series 650; Steel City TC111; Appleton TW50CS.
3. Flexible conduit
   - malleable iron, "squeeze" type, non-insulated; Midwest series 1708; Steel City XC 901; Appleton 7481V. (For lighting fixture whips only - all steel or die cast screw in connector; Midwest 771; Steel City XC 241; Appleton SGC 50DC).
4. Liquid tight conduit
   - steel or malleable iron; Midwest Series LT; Steel City LT 100; Appleton ST.

2.4 Boxes

A. Junction boxes and pull boxes shall be code gauge galvanized steel with multiple screw fasteners and covers.

B. Outlet boxes all steel construction with galvanized or plated finish or otherwise all metal, by Steel City, Appleton, Crouse Hinds, R&S or Raco.

1. Flush mounted device outlet boxes shall be minimum 4 inches square. Provide extension rings as required. Use Caddy No. H2-3 mounting support plate where metal studs are used.
2. Device rings in finished masonry or tile walls shall be square corner masonry type with no extended ears, to allow flush mounting of plates.
3. Floor boxes shall be UL listed for its application as manufactured by Hubbell, Steel City, Walker, Raco or Wiremold.
4. Surface mounted device boxes shall be cast "FS" type or special surface mounted boxes for use with surface raceway systems.

C. Provide watertight boxes, slip expansions and bonding jumpers where dictated by construction conditions.

D. Terminations at boxes shall be secured by locknuts or approved bushings.

2.5 Surface Metal Raceways

A. Snap on cover types by Mono-Systems, Panduit or Wiremold (enamel finish coat to match room finishes in remodel areas). Application - permitted only when specifically shown on the drawings.

B. Fittings, boxes and extension rings: Furnish manufacturer's standard accessories; match finish of raceway.

2.6 Sleeves and Openings

A. Sleeves and formed openings shall be placed in walls, partitions, floor slabs and poured concrete roof decks for the passage of conduit, cable, wireway, cable tray and bus duct. Sleeves and formed openings are not required:

1. In floor slabs on grade.
2. Where conduit is installed before the wall, partition or slab is constructed.
3. Openings are cut for conduit passage and patched with equal or comparable material to close the space around the conduit.
4. In stud and gypsum board or plaster walls and partitions which are not fire rated.
5. For conduit passing thru masonry walls and partitions and stud and gypsum board or plaster walls and partitions. Sleeves are required however, for which expansion, contraction and other movement can be expected.
6. In core drilled openings in solid concrete not requiring water protection. Sleeves are required, however, at core drilling thru hollow pre-cast slabs and concrete block walls, to facilitate containment of required firestopping material.
7. In large floor openings for multiple pipe and duct risers which are within a fire rated shaft, unless the opening is to be closed off with concrete or other material after conduits are set.

B. Sleeves shall be sized to afford 0.25 inches to 0.75 inches clearance space.

2.7 In areas having special membrane waterproofing in or on the floor slab, a Josam 26420, or equal approved by the Architect, riser sleeve with clamping ring and auxiliary conduit sleeve extending 4 inches above finished floor or 8 inches above finished roof shall be used. Waterproofing

membrane for roof floor construction shall be secured by the clamping ring. These are to be used in areas having special membrane water-proofing in or on the floor slab and at roof decks.

2.8 Multiple conduits extending through the roof may be fitted with a manufactured pipe curb weatherproofing assembly equal to Pate pca, lpca and mpca as an alternative to that specified in paragraph 2.7 above.

2.9 Escutcheon plates shall be split-ring chromium plated pressed steel. Plates shall be sized to cover the surface penetration and sleeve. Plates shall be installed on exposed piping in finished rooms and areas where conduits penetrate walls, floors, ceilings or overhead structure.

2.10 Anchors and Fasteners

A. Anchors and fasteners shall be of a type designed and intended for use in the base material to which the material support is to be attached and shall be capable of supporting the intended load and withstanding any associated stresses and vibrations.

B. In general, screws shall be used in wood, masonry anchors on concrete or brick, toggle bolts in hollow walls, and machine screws, bolts or welded studs on steel.

C. Nails shall not be used except for temporary support or for light loads in wood frame construction.

D. In outdoor locations or other corrosive atmospheres, the anchors and fasteners shall be non-corrosive or have suitable corrosion resisting coatings.

PART 3 - EXECUTION

3.1 Conduit shall be run concealed in all finished areas of new construction and elsewhere unless specifically indicated or upon specific permission by the Architect. All conduit shall parallel building lines.

3.2 Conduit shall be run overhead and shall not be run below concrete slabs unless specifically indicated on the drawings and in the legend on the drawings.

3.3 Conduits shall not be installed above the vapor barrier in concrete floors poured on grade.

3.4 Conduit crossing building expansion joints shall have expansion provisions with grounding continuity; use special expansion fittings or other NEC approved method. Refer to the Architectural and Structural floor plans and details for locations of expansion joints.

3.5 Do not install wall-mounted boxes back-to-back in opposite sides of wall. In stud walls, boxes shall be on opposite sides of studs. In acoustic rated walls, boxes shall be separated a minimum of 24 inches.

3.6 Boxes not otherwise accessible in ceilings and walls shall be made accessible by installation of hinged door access panels. Refer to Section 27 05 04 – Basic Communications Materials and Methods.

3.7 Use cast floor boxes for installation in slab on grade; formed steel boxes are acceptable for other installation.

3.8 Work shall be so planned as to:

A. Minimize the number of offsets and junction boxes. For feeder conduits, use all long radius conduit bends or accessibly located large junction boxes with screw covers.

B. Generally run conduit and conductors as high as practicable against underside of floor slab in concrete construction or immediately below the top chord of bar joist construction unless otherwise shown. This high level zone shall be used for running electrical raceways. Running conduits promiscuously at various levels and directions will not be acceptable. Runs at bottom chord level or ceiling grid level will not be acceptable.

C. Where spray on fireproofing is used, coordinate with the General Contractor about installing supports, panel feeders and larger conduits before fireproofing is applied. Branch circuit conduits and smaller size conduits may be run as high as possible on stud walls that go all the way up to the structure; this will minimize damage to spray on fireproofing. Patch and repair damaged spray on fireproofing caused by electrical installation; conduits shall not be fully covered with fireproofing.

D. Coordinate activity in advance to avoid interference with other trades.

E. Provide access to all junction and pull boxes.

F. Maintain 6 inches from conduit to paralleled hot water piping and 4 inches from cross piping and 12 inches from generator exhaust piping.

3.9 Secure feeder conduit to basic structural elements with galvanized strap hangers and clamps; use of trapeze type hangers is encouraged for multiple conduits where space will permit. Galvanized metal clamps and screws may be used for attaching and supporting branch circuit conduit. Non-metallic fasteners shall not be used except plastic inserts may be used in concrete for small conduits. Vertical conduits shall be supported at each floor by clamps.

3.10 Surface mounted horizontal and vertical conduit supports on walls up to a height of 7 feet-0 inches above the floor shall be one or two hole sheet metal pipe straps. Pinch type hangers similar to Minerallac type may only be used at heights greater than 8 feet-0 inches. The use of pinch type hangers similar to Minerallac type are expressly prohibited on ductwork, air handling units and other mechanical equipment below 8 feet-0 inches.

3.11 During construction temporarily cap open ends of conduit. Caution trades to take special care of runs in concrete slabs during pouring.

3.12 Empty conduit installed for communications use or for future systems shall have an insulated pull wire or heavy nylon cord inserted for use in pulling wires.

3.13 Pull mandrel or large swab thru conduit to ensure freedom from debris before pulling wires. Use pulling lubricants sparingly.

3.14 Sleeves for passage of conduit, cables, wireway, cable tray and bus duct shall be placed in the initial stages of construction before concrete, masonry and other general construction activity. Means shall be taken to ensure that the sleeve will not move during or after construction. Beams, columns and other structural members shall not be sleeved except upon approval of the Architect.

3.15 Length of wall sleeves shall be such that the sleeve ends are substantially flush with both sides of the wall or partition. Floor sleeves shall be flush with the bottom and top of the floor slab except, in mechanical rooms and other areas which might have water on the floor, sleeves shall project a minimum of 1 inch above finished floor. Refer to the following paragraph for qualifications and exceptions relating to firestopping.

3.16 Refer to 27 05 05 Firestopping. Sleeves which are a part of firestopping assemblies shall conform to the requirements of the assembly with particular emphasis regarding size, annular space, length, passage or non-passage of insulation and the installation of the sleeves.

3.17 Where firestopping is not required, the annular space between the sleeve, core drilling or opening and the conduit, cable, cable tray, bus duct and raceway shall be closed with caulking to retard the passage of smoke.

3.18 Where permitted by the AHJ, metallic conduits requiring no pipe sleeves in passing thru concrete floors or concrete or masonry walls and partitions, the annular space shall be closed full depth of the penetration with materials and methods compatible with the floor, wall or partition material (concrete, grout or mortar).

3.19 Openings for multiple conduits extending through floors where water protection is required (mechanical rooms, kitchens, other potentially wet areas) may be protected with a 4 inch high by 4 inch wide concrete curb with chamfered corners in lieu of individual sleeves. These concrete curbs may be used in lieu of the Josam 26420 riser sleeve and clamping ring provided the floor membrane and curbing are arranged to maintain the integrity of the membrane.

3.20 Powder actuated fasteners of any type are prohibited in occupied buildings. This includes anchors which are driven into place by any device which produces an impact force by use of a powder charge, compressed air, gas or any other propellant.

3.21 All conduit terminations to be equipped with locknuts and bushings. Conduits 1-1/2 inches and larger shall have insulating bushings, grounding lug and shall have locknuts inside and outside the enclosure.

3.22 Outlet Box Installation

A. Set box square and true with finished building surfaces and trim.

B. Secure boxes firmly to building structure.

C. Verify location of outlets in finished rooms with Architectural Drawings of interior details and finish. In centering outlets and locating boxes, allow for overhead pipes, ducts and mechanical equipment, variations in fireproofing and plastering, window and like, and correct any inaccuracy from failure to do so without expense to the Owner.

D. Maintain symmetry of all outlets as closely as possible within Architectural Elevation contained. For example, the Contractor shall center light fixture over doorway or receptacle in section of masonry wall, if shown in that approximate position. If receptacle is shown in same location as counter or bench, determine countertop height and set receptacle to clear top and trim of counter and render outlet easily accessible.

E. In the event of conflict between locations of electrical outlets as shown on the Electrical Drawings and on the Architectural Drawings, outlets shall be installed in accordance with the latter.

F. The Owner reserves the right to relocate any device as much as 10 feet-0 inches (measured horizontally) from its indicated location at no additional cost, provided the contractor is notified prior to roughing that device in.

3.23 Contractor shall record carefully on a set of "as built" prints the exact location of all feeder conduits.

END OF SECTION

27 05 53
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 No labeling for any system which relies on room names/numbers as part of the equipment/cable labels shall be applied until the final building signage package with approved room names/numbers has been reviewed and incorporated. Labeling done based upon bid document room names/numbers prior to approved building signage package will not be accepted and may require the contractor to revise labeling at their expense.

1.2 Communications Systems Identification

A. Identify all major items of equipment and tag all cables to denote equipment served. Cables shall be tagged at both ends and at each point where the cable is administered.

B. Structured Cabling System

C. Audio/Visual equipment

D. Sound Reinforcement System(s)

PART 2 - PRODUCTS

2.1 Labels

A. Manufacturers:

1. Brady.
2. Brother P-Touch.
3. Equivalent by Tester manufacturer.
4. Equivalent by UTP connectivity manufacturer.

B. Description

1. Machine-printed permanent glossy polyester labels for racks, cabinets, faceplates, and panels. (Brady B-422).
2. Machine-printed, self-laminating vinyl for cabling and patch cords. (Brady B-427)

PART 3 - EXECUTION

3.1 Labeling

A. Contractor to install all faceplate and equipment labels in accordance with manufacturer's recommendations and the specifications. All labels shall be neatly installed and shall be level with the floor and properly aligned on the faceplate.

B. All pieces of voice and data equipment, including wires, cables, fibers and their respective terminations shall be labeled and identified in accordance with ANSI/TIA 606-B.

C. Labels shall meet the requirements of UL 969 as outlined in the ANSI/TIA 606-B.

D. All horizontal and backbone subsystem copper labels shall be labeled at each end. Labeling is required at intermediate points such as pull boxes and consolidation points (where appropriate).

E. Do not install labels closer than 3" to the termination point.

F. Patch panel labels shall be printed with the associated user data jack number.

G. Contractor shall submit a sample of patch panel label strips to the Network Engineer for approval prior to installation.

H. Numbering schemes for fiber panels, copper patch panels and voice wall 110 punch blocks will go in ascending order.

I. Voice and data jack labeling scheme is [Room Number] – [jack number + function]. Ex: 222-V01, 222-D01, 222-V02, 222-D02, 223-V01, 223-D01, etc.

J. Access Control and One Card Data Labels must begin with AC. (Ex: AC-201-D01)

K. Audio Visual (A/V) Data Labels must begin with A/V. (Ex: A/V-201-D01)

L. Labeling shall be consistent at each end of cabling and at workstation outlet and patch panel or connecting block. Data jacks shall be orange located in the outlet bottom position (vertical) or the outlet right position (horizontal). Voice jacks shall be White located in the outlet top position (vertical) or the outlet left position (horizontal). All voice terminates in their own patch panel.

M. Wireless access point jacks labeling scheme is [WAP] - [Room Number]. If the access point is in a corridor, use the closest room number. Labeling shall be consistent at each end of cabling and at WAP outlet and patch panel or connecting block. When a wireless access point is located above the ceiling a label must be placed on the ceiling grid which contains a small red dot and the wireless access point jack number.

N. Security camera jacks labeling scheme is [CAM] - [Last 2 octets of the IP Number].

O. Elevated cameras must have labeling at the bottom which allows for viewing from ground level. Labeling shall be consistent at each end of cabling and at WAP outlet and patch panel or connecting block.

P. All access point and security camera jacks will be terminated together on their own patch panel separate from the workstation data patch panels.

Q. All labels must be based on the final room numbers. Verify room numbering with Owner prior to installation of labels. Do not use room numbers that appear on construction drawings.

END OF SECTION

27 15 13
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 Scope of Work

A. The intent of this specification section is to cover the materials and installation of a structured cabling system and termination equipment as outlined herein and as detailed on the drawings. Work shall consist of

1. Work area outlets including faceplates, jacks (data, A/V), and labels. Boxes and conduit are being provided by Division 26 contractor.
2. Data copper station cabling from work area outlets to telecommunications rooms including termination testing and labeling.
3. Data work area equipment cords.
4. Data horizontal cross-connect jumpers and patch cables including labeling.

1.2 System Description

A. Data station cabling (copper) system shall consist of:

1. Workstation outlet jacks..
2. Security Camera outlet jacks.
3. Wireless Access Point outlet jacks.
4. Data station cabling as specified herein from each outlet to the termination equipment located in the Telecommunications Room (TR).
5. Final connections of the station cabling at the outlet jack and the termination equipment.
6. Cross connects / patch cable to connect outlets to backbone / network electronics unless otherwise noted.
7. Testing and labeling.

1.3 Quality Assurance

A. All work shall be installed in compliance with the latest edition of the Commercial Building Telecommunications Wiring Standard EIA/TIA, ANSI, ICEA, BICSI Standards, applicable National Electric Code Sections, Michigan Building Codes.

1.4 Contractor Qualifications

A. Work shall be performed by a BICSI certified Telecommunications Contractor that is properly certified in the cabling system being installed. Contractor's requesting pre-approval from the Engineer to perform the work as specified in this section shall meet the following requirements:

B. The Contractor must have an on-staff, full time RCDD. The personnel assigned to project manager for this project must be a current RCDD in good standing.

C. The personnel assigned to project foreman at the project site must be a minimum BICSI Level II certified installer.

D. The Contractor must have at least one BICSI Level I certified installer in the daily work crew.

E. The Contractor must hold a current certification from the manufacturer of the proposed cabling system solution. This certification must be valid for both installation and testing and shall enable the Contractor to offer the full manufacturer's product and applications warranties as specified herein.

F. Requests for consideration shall be sent to the Construction Manager/Architect/Engineer (by mail or fax) and shall include the following:

1. Copy of the BICSI RCDD certificate for the Contractor's on-staff, full time project manager.
2. Copy of the BICSI Level I, II and III certificate(s) for the Contractor's on-staff, full time installation personnel. Prior to commencement of work, the Contractor shall submit the resume of personnel assigned to the project. Any approval given during bidding shall be based upon the information submitted. Change in approved personnel prior to completion of the project shall be brought to the attention of the Engineer for review.
3. A letter of certification from the manufacturer for the individuals working on the project must be included with the bid submittal. No exception to this will be allowed. It will not be the responsibility of the Engineer to recognize or respond to incomplete or incorrect requests.

G. It shall not be acceptable for any portion of the work specified herein to be performed by a sub-contractor unless such sub-contractor has been pre-approved by the Engineer in writing. Refer to following requirements:

1. The Engineer will respond in writing to applicants who meet the requirements of this specification or to the project's construction manager. This response will serve as formal notice that the Contractor is approved for the listed project.
2. Contractors who have not received approval from the Engineer prior to issue of formal contracts will not be approved to perform the work outlined in this specification section regardless of their qualifications.

1.5 Shop Drawings

1. Refer to Section 27 05 01 Basic Communications Requirements for submittal requirements.
2. Product Data Sheets
   a. Submittals can be sent electronically to WSU project managers.
   b. The binders shall contain the manufacturer's product data sheets for the specific items to be installed for this project.
   c. The Contractor shall indicate specific color, style, configuration, etc., and all accessories specified and required for a complete installation.
3. Unit pricing
   a. Provide separate unit pricing included with bid for each of the following:
   b. A complete workstation drop of each type of outlet indicated (e.g., A, B, C, etc.) of length 100 feet, including all cabling, connectors, faceplate, labeling, installation, termination, and testing.
   c. Complete schedule C of WSU's purchasing bid package.

1.6 Relevant Standards

A. The Structured Cabling Installation shall comply with the following at a minimum:

1. All local, state and national codes
2. The National Electric Code (NEC)
3. The National Electrical Safety Code (NESC)
4. Electronic Industries Alliance (EIA)/ Telecommunications Industry Association (TIA) 526, 568, 569, 598, 606, J-STD-607, 758 and all applicable and current Technical Service Bulletins (TSB).

1.7 Related Sections

A. The following specification sections shall be deemed to be included in part or in whole and require close coordination to ensure total system interoperability and compatibility:

B. 27 15 43 – Communication Audio-Visual Horizontal Cabling

PART 2 - PRODUCTS

2.1 Structured Cabling System

A. The entire data horizontal station cabling solution shall be a listed EIA/TIA cabling system solution from a single Manufacturer/Source as required by the Manufacturer/Source. Provide a listed Cabling System Solution utilizing cable/components from the following list of acceptable manufacturers:

1. Hubbell NEXTSPEED Cat 6 enhanced
2. Superior-Essex NextGain Cat6EX
3. Leviton-BerkTek Lanmark-2000
4. Belden Cat6+ Premium 3613
5. CommScope Uniprise CS37P Cat6E

B. Category 6e performance is defined by the manufacturers of the above cabling products.

C. All cable installed, patch cords, jacks and patch panels must be same manufacturer and product series and or certified compatible by the manufacturer.

D. Horizontal cabling systems shall be permanent link configuration for data.

E. Horizontal (station) cable shall be plenum rated.

F. Data station cabling shall be terminated utilizing EIA/TIA 568B standards.

2.2 Data Station Cable

G. Horizontal cable shall be furnished with performance requirements for the system served as indicated on the drawings riser diagram.

H. Category 6 enhanced: 23 AWG, 4-pair, 100 ohms, UTP, [CMP], with green jacket for data and wireless access points, yellow jacket for voice cabling, purple jacket for security camera cabling, and blue jacket for Building Automation Systems (BAS). See exact products above.

I. Workstation, server, printer, BAS etc. data jacks will terminate in their own group of patch panels. Wireless access point and security camera data jacks will terminate on their own separate group of patch panels. All patch panels are installed in the equipment racks. No wall mounted patch panels allowed without authorization from C&IT.

J. Each cable shall be a dedicated home run from the workstation outlet jack to the data termination equipment in the MER/TR. Terminate cable at the workstation and at the MER/TR termination equipment as specified herein and as indicated on the drawings.

K. Provide sample of labeling to Owner to review and approve prior to execution of work. Cable shall be labeled within 12” of termination at both ends to indicate patch panel and port served.

2.3 Workstation Outlets

A. Data Jacks

1. 8 position, 8 conductor, non-keyed, universal modular jack, snap-in type, terminated with a 110-style pc board connector, color coded for T568A and T568B wiring.
2. Designed to terminate 22-26 AWG solid on insulation-displacement.
3. 110-style connectors.
4. Contacts shall be minimum 50 micron gold-plated in the contact area.
5. Rated to match the performance of the cabling system they are installed on.
6. Color coded for system served as indicated on the Drawings.
7. Furnish keystones (icons) for jack identification. Keystones for voice, data, wireless access points and security cameras jacks shall be [orange].

   Provide the following:
   a. CommScope UNJ600, or equivalent per the following manufacturers
   b. Leviton
   c. Hubbell
   d. Belden

B. Outlet Components

a. Manufacturers: Same as jacks and connectors, unless otherwise noted. In almost all cases in labs, stainless steel plates will be called out in lieu of plastic. Reference construction drawings.
b. Face plates for wall mounted workstation outlets shall allow a minimum of 2 and maximum of 6 positions and accept snap-in jacks, as specified.

2.4 Data Termination Equipment

A. UTP patch panel

1. Patch panel shall serve as data jack, voice jack, security camera and wireless access point system horizontal cross connect.
2. Wireless access point and security camera data jacks will be terminated on their own patch panel separate from the workstation data jack patch panels.
3. Patch panel shall be configured for standard 19” rack mounting.
4. High density type with snap in 24 modular jack ports for every standard rack mount unit (1.75" high).

5. Maximum 6 port groupings of replaceable modules.
6. Terminations for the “building side” cabling on 110-style insulation PC board connectors color-coded for T568B terminations.
7. Horizontal and vertical cable management hardware front and rear.
8. Performance shall meet the performance of the cabling system they are installed on.
9. Constructed of black anodized aluminum with adequate structural integrity so that panel will not deflect when center of panel is pushed with the hand.
10. Provisions for icons and labeling to comply with the labeling requirements in WSU specification 27170, "Cable Plant Administration and Testing". Provide quantity of patch panels as required by quantity of data station cable. Mount panels in equipment racks/cabinets as indicated on drawings. Each panel shall be fully loaded.
11. Provide the following:
    a. CommScope UNP-6-DM-1U-24 or UNP-6-DM-2U-48, or equivalent by the following
    b. Leviton
    c. Hubbell
    d. Belden

B. Provide sample of labeling to Owner to review and approve prior to execution of work.

C. Provide quantity of copper patch panels to accommodate complete termination of all installed copper station cables plus an additional 20 percent spare capacity.

2.5 UTP Patch Cords

A. Manufacturers

1. Shall be the same manufacturer and type as the cable, jacks and patch panels installed in the building.

B. Description

1. Provide one (1) 1’ patch cord for each data port installed in the patch panel.
2. Provide one (1) 10’ patch cord for each data port installed at the workstation area.
3. For the workstation room side provide patch cords with stranded conductors and jacketing for greater flexibility.
4. Patch cords shall be grey color for the workstation, and telecommunication room areas. Patch cords shall be grey color for the access point. Patch cords shall be purple color for the security cameras. Patch cords shall be blue for BAS.
5. Coordinate possible different lengths with C&IT prior to placing order. Project or scope change could require different lengths than on the original submittals.

PART 3 - EXECUTION

3.1 General Installation

A. Make all data terminations at the TR termination equipment and at each workstation outlet jack utilizing a tool appropriate for the equipment as recommended by the equipment manufacturer.

B. Refer to section 27 05 01 Basic Communication Requirements for more information regarding Owner furnished contractor installed equipment.

C. In addition to the notes contained on the Drawings, the following Contractor notes shall apply.

1. Cable routing

a. Route all cables and cable raceways parallel to or perpendicular to building structure.
b. All cables shall be installed as single continuous "homerun" pulls from connector block to connector block, or from patch panel in the telecommunications room to the data workstation outlet in the work area.
c. Cable that is installed above a suspended ceiling must be supported per NFPA code requirements. Three choices are, conduits, cable tray or by J-hooks.
d. No tie-raps or bundling allowed.
e. The maximum spacing of cable hangers, supports and the number of data cables per hanger shall not exceed BICSI specification.
f. The installation contractor shall be responsible to replace all fire-proofing materials required for the installation. Any missing fire-proofing materials shall be reported to WSU for repair to maintain required fire rating of structure.
g. Telecommunication cable and infrastructure shall be independently supported.
h. Do not support or tie-wrap any cables to ductwork, plumbing lines, fire suppression, electrical conduits, telecommunication conduits, mechanical systems, or ceiling system.
i. Do not route cables through a block wall without a proper sleeve, directly lay data cables on ductwork, piping and plumbing systems or on top of the lay-in ceiling tile.
j. All cable must be free of tension at both ends as well as over the length of the run. Only Velcro straps are permitted as cable bundle supports. Waterfalls from cable tray shall not pinch, bind, crimp or in any way deform or cause physical damage to the cable jacket or alter the electrical characteristics of the data cables.
k. Contractor shall take care to assure that during and upon completion of the installation, all cables are free of kinks, sharp bends, twists, gouges, cuts or any other physical damage which may cause physical or electrical characteristic alterations to the cables. The cables must also be installed at the proper room temperature. Any of these conditions will constitute a replacement of the installed cable.
l. Contractor to observe all minimum bend radius and tension limitations, etc., as specified by the cable manufacturer when installing the cables.
m. Contractor shall supply neatly bundled slack loops of length 10 feet for all cabling in telecommunications spaces. Provide neatly bundled slack loop 1 foot above the ceiling at workstation end.
n. Provide Velcro cable ties periodically in all runs and within the telecommunications spaces.
o. Provide slack loops per BICSI standards.

2. Cable terminations

a. The certified contractor who installs the telecommunications cabling must be the one who terminates the telecommunications cabling and tests the finished data link / channel. It is not allowed to have a non-certified electrical contractor install the telecommunications cable and have another certified contractor terminate, test and warranty the product. No exceptions to this will be allowed. Terminate all wiring at both ends using the T568B convention. All voice and data cables shall be terminated in accordance with ANSI/TIA 568-C installation guidelines.

b. Terminate all wiring at both ends using the T568B convention. All voice and data cables shall be terminated in accordance with ANSI/TIA 568-C installation guidelines.
c. All data cables shall be terminated on rack mounted, high density, patch panels.
d. Wireless access points, security cameras and all other “internet of things” data jacks will be terminated on their own patch panel separate from the workstation data jack patch panels.
e. All data jacks above ceiling must be orange, securely mounted and labeled. No free floating or double stick mounted jacks are allowed.
f. All cable terminations shall be free of stress or tension when complete.

3. Outlets

a. Data jacks are installed in outlet boxes on the wall, approved raceways or directly wired and mounted cubical furniture.

4. Face plates

a. Contractor shall provide standard faceplate with blank inserts for all outlets indicated as "future".

5. Patch panels

a. Mount patch panel according to equipment rack elevations.

3.2 Wiring Installation

A. Data station cable shall not exceed the EIA/TIA maximum lengths for the specified Category rating. The contractor shall be responsible for verifying adequate cable pathways to limit cable lengths prior to installation. Where existing or designed pathways do not allow for compliance to distance limitations for data cabling, the contractor shall provide alternate pathway routes to the Engineer for review.

B. Interior - All data station cables shall be run in conduit from outlet to above accessible ceiling as indicated on drawings and specifications. All cabling shall be run parallel or perpendicular to building lines. The contractor will be responsible for all cable management required to support cables per standards between installed fixed raceways (conduit, J Hook, wireways, etc.).

C. The drawings do not indicate specific routes for telecommunications cables. The Contractor is responsible for developing all cabling routes utilizing existing cable management pathways and systems or providing supplemental cable management pathways and systems so that all structured cabling adheres to specific codes and standards specifically developed for the installation of such cables. Where the use of existing cable management systems and pathways would cause the structured cable system to violate specific codes and standards regarding cable lengths, environments, proximity to EMI and RF noise sources, etc., the Contractor shall be responsible for developing alternative pathways and shall include all labor and material for doing so within the scope of this work.

D. In areas where there is not an installed raceway system (conduits or cable tray) and a cable support system is required, this contract shall be responsible for providing a Cable

Management System. Cable management system shall provide support no more than 5 feet on center. Where cables are installed open wired through the use of cable management systems, they shall be installed such that there is a minimum sag of 4 inches for every 4 foot of horizontal run. Cable pathways shall provide the following minimum clearances (parallel or perpendicular):

1. Motors and transformers – 48 inches
2. Conduit and cable used for electrical power distribution – 12 inches
3. Fluorescent lighting – 5 inches
4. Power lines up to 2kVA – 5 inches
5. Power lines over 5kVA – 24 inches
6. Hot water/steam lines - Bare –18 inches, Insulated – 6 inches

E. Cable management system shall be secured to building structure utilizing manufactured approved methods and hardware.

F. Cable management system support components shall be designed with wide support surfaces that do not cause cables to be bent, crushed or otherwise deformed when installed within component loading parameters. Cable management system shall meet UL standards and be UL labeled. Utilizing elements of the building's structure such as beams, joists, etc. to hang cable from will not be acceptable.

G. Each data jack shall be wired with a dedicated home run. Each data jack shall be identified. The jacks shall be labeled on the faceplate. Station cables shall be labeled at TR termination point with corresponding workstation outlet jack number.

H. Data cables shall be handled and installed with extreme care. Twisted pairs shall be untwisted less than .5 inch at terminations for Category 6e. Tie wraps shall loosely hold cables; do not overtighten. Cables shall have sweeping bends and shall have a maximum bending radius at any point in the installation of not less than 4 times the outer diameter of the cable. The cable manufacturer's recommended bending radius and maximum pulling tensions shall be strictly adhered and shall not be exceeded. Failure to comply will result in the removal and replacement of affected cable at no additional cost to the Owner.

I. Data horizontal station cable shall not exceed the EIA/TIA guidelines for LINK distances. The permanent LINK shall be as defined in the EIA/TIA standards as the distance from the workstation outlet jack to the MER/TR termination equipment patch panel/cross-connect port.

J. Where cables are installed in conduit, the conduit system shall conform to the following:

1. No section of conduit shall be longer than 100 feet between pulling points.
2. No more than two 90 deg. Bends in a section of conduit between pulling points.
3. Pulling points/pullboxes shall not be used to change direction of the conduit pathway. Pulling points/pullboxes shall be placed "in-line" with the conduit pathway.
4. Each section of conduit shall be labeled for length, destination closet and origination closet.
5. Refer to EIA/TIA 569-A for specific conduit and pull box requirements.

K. All cabling installed in underground conduit installations shall be outdoor rated cables, acceptable for use by the manufacturer in underground applications.

3.3 Identification/Labeling

A. Refer to Section 27 05 53 Identification For Communications Systems.

3.4 UTP System Testing

A. Upon completion of the cable installation, the Contractor shall perform complete copper cable certification tests, according to all manufacturer's requirements for application warranty, testing required by TIA/EIA, including, but not limited to:

1. Continuity checks on each cable, checking for opens and shorts.
2. Cable length (Channel and Permanent Link).
3. Correct pair polarity.
4. Correct cable labeling at both ends.
5. Tests shall be performed with connectors installed.
6. Any UTP CAT6 cable or component that has been painted and / or not satisfactorily passing tests or failing to meet quality installation standards as described in the specification, shall be repaired and/or replaced as directed by C&IT Network Engineer at the Contractor's expense.
7. The Contractor shall prepare complete cable test reports for all installed cables for review and acceptance by WSU C&IT Network Engineering prior to acceptance and / or use of the cabling system.
8. Category 6E UTP cable patch cords shall be manufactured, fully tested and verified in accordance with product specifications. No field made patch cords allowed.
9. All cable testing shall be conducted by a certified technician using a Level III minimum Fluke Networks DSX 8000, or C&IT Network Engineering approved equivalent certification tester.
10. The cable tester calibration must be up to date. Test results must have the operator with company name, WSU building project name and cable type field. The cable type field identifies the cable product type installed and tested.
11. The test results must be submitted in one file / PDF format to C&IT for approval.
12. The Category 6E Horizontal Cable Certification reports shall have complete testing of channel for voice and data drops, at frequency increments up to 450MHz and set the cable length limit to 295’ as indicated in ANSI/TIA-568-C and test results will show the following:
13. Cable ID Number which matches faceplate numbers and patch panel numbers
14. Tester Calibration Validation Date. Must be calibrated every year.
15. Building Project Name, Test Date, operator and company names.
16. Cable Length
17. Wire-Map
18. Network Tests for 100BASE-TX and 1000BASE-T
19. Attenuation
20. Near End CrossTalk (NEXT)
21. Power-sum NEXT (PS-NEXT)
22. Attenuation to Cross Talk Ratio (ACR)
23. Power-sum Attenuation to Cross Talk Ratio (PS-ACR)
24. Equal Level Far End CrossTalk (ELFEXT)
25. Power-sum Equal Level Far End CrossTalk (PS-ELFEXT)
26. Return Loss
27. Propagation Delay
28. Delay Skew

29. Signal to Noise Ratio

B. Upon completion, before final payment the following must be provided:

1. Provide (1) electronic copy of test results in PDF file format.
2. Provide the manufacture warranty certificate upon completion.
3. Test date.
4. Tester make, model and calibration date.
5. No exception to this will be allowed.

C. After the horizontal cable tests have been performed, the Contractor shall install the faceplate labels and modular jack dust covers.

3.5 System Acceptance Requirements

A. The contractor shall submit printed test results per the testing specification requirements for review by the Engineer/Owner prior to system acceptance. Any cable components that have not passed the full requirements of the system testing shall be replaced and re-tested at the contractor's expense prior to system acceptance.

3.6 As-Built Documentation

A. Refer to Section 27 05 01 for submittal requirements.

B. Copies of all approved shop drawings with the Engineer's stamp.

C. Owner's manuals for every item of equipment when available from the manufacturer. These shall be the technical manuals provided by the manufacturer and shall not consist of generic sales brochures. Technical manuals shall provide complete specifications for the equipment as well as complete operating, maintenance, troubleshooting and product repair/replacement information. Where available only in electronic format, the contractor may provide a CD with electronic versions of Owner's manuals. CDs containing electronic versions of Owner's manuals must contain the proper software viewers for each document type.

1. Termination cabinets, panels and enclosures

D. Technology drawings updated with final as-Built information. This shall be in the form of a complete set of Technology drawings with as-built information indicated in colored pen based upon actual field conditions.

1. AutoCAD architectural floor plans at a scale of 0.125 inches =1 foot-0 inches on 30x42 size sheets showing the location and label of each workstation outlet, IDF closet and MDF closet. Labeling shall match the labeling installed in the field. These drawings shall be as-built conditions.
2. AutoCAD architectural floor plans at a scale of 0.25 inches =1 foot-0 inches on 30x42, 24x36 size sheets showing the telecommunications equipment layout in each IDF closet and the MDF closet. This layout shall include the racks, backboards, cable tray, conduit sleeves, 120V power, etc. Each piece of equipment where labeled in the field shall have the corresponding label on these plans. These drawings shall be as-built conditions.

3. System schematic and block diagrams for every system updated with final as-built information. These drawings shall define the exact arrangement of each system including wiring configuration, device locations and cable types.
4. Rack elevations for all systems with rack mounted equipment. The details shall indicate each piece of telecommunications equipment in each rack including equipment labels such as patch panel, wire management panel, blank panel, space, etc. Each port of each patch panel shall be fully labeled to match the labeling installed in the field.

E. Cable Test Results - Provide bound documents of all cable test results in printed format and in software version on a compact disc. Software version must include any required reader software where file formats are proprietary or non-standard text files. Cable test results shall be organized by media (fiber, copper) and by closet. Information must be included in O&M Manuals.

1. Copper Test Results
   a. Documentation shall be in the following format:
      1) Cable ID
      2) Test parameter used
      3) Date of test
      4) Length
      5) Pass / Fail result

F. Create a detailed records sheet for the station cabling including floor plans showing outlet locations and which jacks are in which outlet. Records shall indicate connection rack/backboard, patch panel / cross-connect and jack / port, at both ends, for each cable. Provide with O&M Manual.

G. The entire structured cabling system as specified herein shall be guaranteed against defects in workmanship and materials as described herein. Provide a written statement of this warranty as part of the shop drawing submittal and included in the O&M Manuals.

3.7 Warranty

A. The entire structured cabling system as specified herein shall be guaranteed against defects in workmanship and materials. Period shall commence after system has been commissioned by the Owner, Engineer and Architect. The Installing Contractor shall provide the initial warranty service. The extended warranty shall be provided by the manufacturer. Provide a written statement of this warranty as part of the shop drawing submittal and included in the O&M Manuals.

B. The warranty shall not be affected by the use of power over Ethernet on any or all of the links.

C. The UTP voice and data cabling system is warranted by the manufacturer(s) “Application Warranty” of the components for a period of not less than 20 years from the time the installation is deemed complete, provided certified installation and testing is followed.

D. It shall be the sole responsibility of the low voltage cabling Contractor to register the project with the manufacturer(s) and meet all manufacturers' “Application Warranty” requirements.

E. It shall be the sole responsibility of the low voltage cabling Contractor to provide Owner with test results, all manufacturers' warranty certificates with Record Documents including a site plan elevation with outside plant manholes, hand holes and conduit pathways.

F. Warranty Coverage

1. Product - all passive components of the cabling system shall be warranted to be free from defects in material and workmanship for the entire duration of the warranty.
2. Paint or any other material on the UTP cable voids the warranty. If this can't be removed during the installation, the effected cables will need to be replaced.
3. Any UTP CAT6 cable or component that has been painted and / or not satisfactorily passing tests or failing to meet quality installation standards as described in the standards will be repaired or replaced as directed by C&IT Network Engineering Group at the contractor's expense.

G. Warranty Requirements

1. Provide a channel warranty for all data drops.
2. Warranty shall cover repair or replacement of all defective components free of charge, including all labor performed by a manufacturer-certified installer.
3. All new or replacement components shall be furnished new. Never used, reused, reconditioned, or refurbished components are allowed by the manufacture.
4. The installing contractor must be certified by the cabling and connector manufacturers as an approved and trained installer of their equipment & product.

3.8 Certification

A. The contractor shall be responsible for filing all required paperwork on behalf of the Owner to acquire the system performance warranty and certification as outlined in the Structured Cabling System Solution.

END OF SECTION

27 15 43
COMMUNICATIONS AUDIO-VIDEO HORIZONTAL CABLING

PART 1 - GENERAL

1.1 Scope of Work

A. The intent of this specification section is to cover the materials and installation of a structured cabling system and termination equipment as outlined herein and as detailed on the drawings. Work shall consist of:

1) Work area outlets including faceplates, jacks and labels. Back boxes and conduit are being provided by Div 26 contractor.

2) Audio/Video cabling between local A/V outlets, A/V equipment and A/V distribution systems including termination, testing and labeling.

3) Audio/Video patch cables at both work area outlets and Audio/Visual equipment.

1.2 System Description

A. Local Audio and Video Cabling System

1) Workstation outlets and cabling consisting of:

a) High-Definition Multimedia interface (HDMI)
b) DTP / HDBaseT
c) Speaker Cabling

2) Local audio and video cable terminations on the technology outlet, video outlet, and other miscellaneous A/V outlets.

3) Testing and labeling.

1.3 Quality Assurance

A. All work shall be installed in compliance with the latest edition of the Commercial Building Telecommunications Wiring Standard EIA/TIA, ANSI, ICEA, BICSI Standards, applicable National Electric Code Sections, Michigan Building Codes.

B. All materials furnished under this contract shall be new, of the highest quality and shall be of a regularly manufactured line and shall be the most current model in production at the time of installation.

1.4 Shop Drawings

A. Refer to Section 27 05 01 Basic Communications Requirements.

B. A complete list of materials with model and part numbers and references to the Part 2 specification paragraph numbers.

C. Manufacturers Data Sheets of all products and cabling, specific to the project. Data sheets shall show the exact parts, with model numbers and options as required and clearly identified.

1.5 Relevant Standards

A. The Structured Cabling Installation shall comply with the following at a minimum:

1) All local, state and national codes

2) The National Electric Code (NEC)

3) The National Electrical Safety Code (NESC)

4) Electronic Industries Alliance (EIA)/ Telecommunications Industry Association (TIA) 526, 568, 569, 598, 606, ANSI/TIA-607B, 758 and all applicable and current Technical Service Bulletins (TSB).

PART 2 - PRODUCTS

2.1 Structured Cabling System

A. Modular HDMI, USB – to match data station faceplate solution. Refer to Section 27 15 13 Communications Copper Horizontal Cabling.

B. Horizontal (station) cable shall be plenum rated.

C. DTP/HDBaseT for video displays:

1) Provide West Penn Wire CAT 6A F/UTP CMP, part number 254345AF or equal.

2.2 Local Video and Audio Cable

A. Digital Video Cable

a) Provide where manufacturer specific video cabling will not be used.

b) HDMI – One-piece, connectorized fiber optic cable assembly that supports 4K resolution and Dolby True HD and DTS-HD Master audio. Provide cables that are tested and verified to meet these specifications for the specific length of cable provided. Utilizing USB power or external power supply are not acceptable. Physical characteristics:

(1) 24k gold-plated connectors
(2) 24 AWG high-purity, oxygen-free conductors
(3) High-density triple shielding for rejection of EMI and RFI
(4) UL Listed, CL2P, CL3P and CMP certified

Approved manufacturers:

a. Extron
b. Biamp
c. FSR-DR-PCB-HxxM
d. Liberty DL-AOCHP-xxxM
e. Covid P=HDFH

B. Audio Cable

1) Speaker level - Stranded 16AWG copper twisted pair from the equipment rack to the loudspeaker(s).

2.3 Workstation Outlets

A. Local Classroom Audio/Video Jacks

1) Modules shall be by same manufacturer as workstation data jacks.

B. Outlet Components

1) Faceplates shall be modular 6 port and shall accept the approved video jacks including Audio-Video (HDMI). Faceplates and jacks shall be by a single manufacturer. Equipment to be of manufacturer and series as required by Specified Link/Channel Solution Warranty. Color as selected by Owner.

a) It shall not be acceptable to utilize standard outlet style-line faceplates with modular mounting straps for the jacks. All jacks must mount directly to modular ports within the faceplate.

b) Where standard faceplates are not available from the manufacturer or the full line of jacks designed at a particular location, the contractor shall be responsible for providing a custom punched and engraved faceplate to meet the application.

2) Each and every audio/video jack shall be labeled to indicate function (HDMI, etc.). Coordinate labeling scheme with Owner. Labels shall be computer generated on an adhesive media and attached to the workstation outlet. Labels applied with pens or markers will not be acceptable.

3) Outlets to be installed in faceplates or compatible with floor box locations. The use of loose or un-mounted jacks shall not be acceptable.

4) Provide blank inserts for all unused ports.

5) Refer to drawings for arrangement of various workstation outlets including jack types and quantities within each outlet type. All data/video/audio and fiber jacks indicated in the faceplate shall be deemed included in this specification unless specifically noted otherwise.

6) Outlet faceplates shall be same material/finish as faceplates of adjacent electrical outlets unless specifically indicated or otherwise required for custom applications.

2.4 Station Cable Termination Assignments

A. Refer to the drawings for assignment of local A/V station cabling to the respective outlets and equipment.

PART 3 - EXECUTION

3.1 General Installation

A. Refer to drawings for quantity and arrangement of technology outlets including jacks and cabling.

B. Make all terminations at outlets and equipment and at each workstation outlet jack utilizing a tool appropriate for the equipment as recommended by the equipment manufacturer.

C. Coordinate color requirements for all jacks, station cables, patch cables, etc. with Owner / Engineer. Color coding shall be consistent for all like equipment.

D. Delivery of all loose equipment which is to be turned over to Owner shall be carefully coordinated and scheduled with Owner prior to shipment.

3.2 Wiring Installation

A. Interior - All station cables shall be run in conduit / surface raceway from outlet to above accessible ceiling extended from suspended cable management system out to local outlet or equipment as indicated on drawings and specifications. All cabling shall be run parallel or perpendicular to building lines.

B. The drawings do not indicate specific routes for telecommunications cables. The Telecommunications Contractor is responsible for developing all cabling routes utilizing existing cable management pathways and systems or providing supplemental cable management pathways and systems so that all structured cabling adhere to specific codes and standards specifically developed for the installation of such cables. Where the use of existing cable management systems and pathways would cause the structured cable system to violate specific codes and standards regarding cable lengths, environments, proximity to EMI and RF noise sources, etc, the Telecommunications Contractor shall be responsible for developing alternative pathways and shall include all labor and material for doing so within the scope of this work.

C. In areas where there is not an installed raceway system (conduits or cable tray) and a cable support system is required, this contract shall be responsible for providing a Cable Management System. Cable management system shall provide support no more then 5’ on center. Where cables are installed open wired through the use of cable management systems, they shall be installed such that there is a minimum sag of 4 inches for every 4 foot of horizontal run. Cable pathways shall provide the following minimum clearances (parallel or perpendicular):

1) Motors and transformers – 48".
2) Conduit and cable used for electrical power distribution – 12".
3) Fluorescent lighting – 5".
4) Power lines up to 2kVA – 5".
5) Power lines over 5kVA – 24".
6) Hot water/steam lines - Bare –18", Insulated – 6".

D. Cable management system shall be secured to building structure utilizing manufactured approved methods and hardware.

E. Cable management system support components shall be designed with wide support surfaces that do not cause cables to be bent, crushed or otherwise deformed when installed within component loading parameters. Cable management system shall meet UL standards and be UL labeled. Utilizing elements of the building's structure such as beams, joists, etc. to hang cable from will not be acceptable.

F. Cables shall be handled and installed with extreme care. Tie wraps shall loosely hold cables; do not overtighten. Cables shall have sweeping bends and shall have a maximum bending radius at any point in the installation of not less then 4 times the outer diameter of the cable. The cable manufacturer's recommended bending radius and maximum pulling tensions shall be strictly adhered and shall not be exceeded. Failure to comply will result in the removal and replacement of affected cable at no additional cost to the Owner.

G. Where cables are installed in conduit, the conduit system shall conform to the following:

1) No section of conduit shall be longer then 100 feet between pulling points.
2) No more than two 90 deg. Bends in a section of conduit between pulling points.
3) Pulling points/pullboxes shall not be used to change direction of the conduit pathway. Pulling points/pullboxes shall be placed "in-line" with the conduit pathway.
4) Each section of conduit shall be labeled for length, destination closet and origination closet.
5) Refer to EIA/TIA 569-A for specific conduit and pull box requirements.

H. All cabling installed in underground conduit installations shall be outdoor rated cables, acceptable for use by the manufacturer in underground applications.

3.3 Identification/Labeling

A. The Contractor shall be responsible for labeling all supplied communications equipment, cable, etc. in accordance with the guidelines as described herein. The end of each cable, each jack, patch panel, cross-connect and rack/backboard shall be identified and permanently recorded on 8.50 X 11 sheets attached to each rack/backboard.

B. Each cable and jack shall be labeled at every location where they are administered per TIA/EIA-606.

C. This contractor shall be responsible for creating/maintaining the numbering scheme as directed by the Owner and the WSU Standards.

D. All labeling and recording shall be approved by the Owner and the Engineer prior to application.

3.4 Testing General

A. The Contractor shall be responsible for testing all installed Structured cables including:

1) Audio-Video

B. No testing shall be executed until the entire system has had the Owner approved labeling scheme applied and accepted. All final test reports shall utilize the field installed labels at each outlet for the test of the corresponding outlet. Test reports which contain temporary generic or incorrect labels will not be accepted.

C. The Contractor shall be responsible for testing all installed audio-video station cables.

D. System testing shall be performed with final test results turned over to the Owner prior to acceptance of the system. Missing or incomplete test results will not be reviewed and the system will not be commissioned by the Owner / Architect / Engineer.

E. Instruments and labor required for tests shall be furnished by the Contractor. All system test equipment shall be approved by the Owner / Architect / Engineer prior to application.

F. The Owner / Architect / Engineer reserve the right to spot test 5% of the installed cabling plant to verify documented test results. Where the Owner / Architect / Engineer have determined that the installed cable plant does not agree with the documented test results, the contractor shall be responsible for re-testing the installed voice/data/fiber cabling plant and revising/updating all test documentation as required.

G. Instruments required for tests shall be furnished by the Contractor.

3.5 Testing A/V Cabling

A. System shall be tested by and a certificate of inspection shall be furnished by a qualified manufacturer's representative or equipment vendor; Submit report indicating result to the Engineer.

B. Contractor shall provide a copy of the field test reports that indicate room/cable tested/result/tester's initials/date of test.

3.6 Coordination with Communications Service Providers – Not Applicable

3.7 Training Requirements – Not Applicable

3.8 System Acceptance Requirements

A. The contractor shall submit printed test results per the testing specification requirements for review by the Engineer/Owner prior to system acceptance. Any cable components

that have not passed the full requirements of the system testing shall be replaced and re-tested at the contractor's expense prior to system acceptance.

3.9 As-Built Documentation

A. Refer to Section 27 05 01 for submittal requirements.

B. Copies of all approved shop drawings with the Engineer's stamp.

C. Technology drawings updated with final as-built information. This shall be in the form of a complete set of Technology drawings with as-built information indicated in colored pen based upon actual field conditions.

1) AutoCAD architectural floor plans at a scale of 0.125"=1'-0" on 30x42 size sheets showing the location and label of each workstation outlet, IDF closet and MDF closet. Labeling shall match the labeling installed in the field. These drawings shall be as-built conditions.

2) System schematic and block diagrams for every system updated with final as-built information. These drawings shall define the exact arrangement of each system including wiring configuration, device locations and cable types.

D. Cable Test Results - Provide bound documents of all cable test results in printed format and in software version on a compact disc. Software version must include any required reader software where file formats are proprietary or non-standard text files. Cable test results shall be organized by media (fiber, copper) and by closet. Information must be included in O&M Manuals.

E. Create a detailed records sheet for the station cabling including floor plans showing outlet locations and which jacks are in which outlet. Records shall indicate connection rack/backboard, patch panel / cross-connect and jack / port, at both ends, for each cable. Provide with O&M Manual.

F. The entire structured cabling system as specified herein shall be guaranteed against defects in workmanship and materials as described herein. Provide a written statement of this warranty as part of the shop drawing submittal and included in the O&M Manuals.

3.10 Warranty

A. The entire structured cabling system as specified herein shall be guaranteed against defects in workmanship and materials for a period of three (3) years. Period shall commence after system has been commissioned by the Owner, Engineer and Architect. The Installing Contractor shall provide the initial warranty service. The extended warranty shall be provided by the manufacturer. Provide a written statement of this warranty as part of the shop drawing submittal and included in the O&M Manuals.

END OF SECTION

SECTION 27 41 16

INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 Scope

A. The work described by this section includes the furnishing of all components, materials, equipment, installation and technical labor and the performance of all operations necessary for the complete installation of audio-visual systems in operating condition as indicated on the drawings and/or specified herein.

B. In general, the conduit and/or cable tray, junction boxes, electrical power circuits and outlets and terminal cabinets, as required for a complete operating system, shall be furnished and installed by the Electrical Contractor under a separate contract. The entire responsibility for the system, its installation, operation, and function shall be that of the Systems Contractor.

1.2 Description of Work

A. Work consists of new A/V Systems as detailed on the drawings and specified herein.

B. A/V Distribution Systems are required to be complete with sources, inputs, displays, distribution, controls and connection to the data network as detailed on the drawings and specified herein.

C. All material and/or equipment necessary for proper operation of the system(s), not specified or described herein, shall be deemed part of these specifications.

1.3 Quality Assurance

A. Performance Verification: All digital video systems shall be pre-tested to verify the complete compatibility of all sending, receiving and distribution components and the performance and integrity of the transmission media. The performance of each system shall be demonstrated, with all proposed components, in the presence of the Design Engineer and/or Owner prior to approval and installation. Any system failing to meet the specified performance requirements shall be rejected and re-configured as required prior to re-testing.

B. All system components shall be UL listed.

C. Installation shall be in compliance with the National Electric Code and all other applicable codes.

D. All equipment described herein or otherwise required to perform the specified system functions shall be a regular product line, produced by the system manufacturer.

E. All materials furnished under this contract shall be new, of highest quality and shall be of a regularly manufactured line, currently in production at the time of installation.

1.4 Contractor Qualifications

A. The A/V equipment package shall be furnished and installed by a contractor who meets all the requirements listed herein. It shall not be acceptable for the A/V contractor to utilize a Subcontractor for any portion of the work, unless the Subcontractor has been approved in writing by the Engineer based upon adherence to the qualifications listed herein.

B. The Contractor shall maintain a fully equipped, factory certified service organization capable of providing full maintenance and service of the installed system within 24 hours. This facility shall be available for inspection by the Engineer.

C. Equipment supplier shall have a service organization within 75 miles of the project site.

D. The Contractor shall have on staff an Infocomm International-certified CTS-I AV systems engineer/project manager responsible for overseeing the project and the lead technician (not installers) shall have a CTS certification.

1.5 Shop Drawings

A. Refer to Section 27 05 01 Basic Communications Requirements.

B. A complete and comprehensive list of materials with quantity, manufacturer, model and part number and reference to the Part 2 specification paragraph number for each item.

C. Manufacturers Data Sheets of all products and cabling, specific to the project. Data sheets shall show the exact parts, with model numbers and options as required and clearly identified.

D. Qualifications: A statement of contractor's qualifications to verify compliance with other provisions within the specifications, unless the contractor has been pre-approved.

E. Job specific diagrams.

1. This indicates a block schematic diagram that shows all major items of equipment required for the contract project and the actual interconnections that will be installed, including details of interconnection with other systems.
2. Electrical power requirements for the head-end and ancillary equipment. Include diagrams for any remote control of electrical power, in sufficient detail to coordinate with electrical work. Electrical diagrams shall also indicate all required plug and power outlet configurations including where direct connection is required/preferred.
3. Rack elevations showing the configuration of all rack mounted equipment.
4. 30x42 floor plans at a scale of not less than 1/8 inch=1 foot-0 inches showing the location of all items of equipment. Drawings shall also indicate each location where electrical power is required, and the specific configuration of that power connection (voltage, plug type, mounting height, etc.)
5. Proposed construction details for all custom fabricated items, including wall plates, interface panels, mounting hardware and systems, and rigging hardware. These details shall show labeling, dimensions and indicate finishes and color selection.

F. Software data – The data package shall consist of manufacturer's data sheets of all system and application software being provided with sufficient information to verify that all specified features and functions are being addressed.

PART 2 - PRODUCTS

2.1 Product Equivalency

A. Where products are listed with multiple manufacturers, these manufacturers will be approved as equals if all specified features are provided. Any equipment not specifically approved in writing prior to the bid date will not be considered regardless of qualifications. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate equipment at the Contractor's expense.

B. Different manufacturers may require various options, accessories, converters, patch cables, etc. to perform the specified features and functions. Therefore, all material and/or equipment necessary for proper operation of the system shall be deemed part of these specifications.

2.2 Sources

A. HDBaseT Transmitter (Rack Mount)

1. The Transmitter shall be rack-mountable
2. The Transmitter shall be a minimum of HDCP 2.2 compliant
3. The Transmitter shall be capable of reading EDID information
4. The Transmitter shall be capable of signal transmission for up to 230 feet
5. The Transmitter shall support HDMI 1.4 and HDMI 2.2
6. The Transmitter shall support the following resolutions:
   a. 1920x1080 @ 60 Hz
   b. 2560x1600 @ 60 Hz
   c. 4096x2160 @ 30 Hz (DCI 4K)
   d. 3840x2160 @ 30 Hz (UHD 4K)
   e. 3840x2160 @ 60 Hz (4:2:0 chroma subsampling)
7. The Transmitter shall support up to 12 bit color depth
8. The Transmitter shall be capable of at a minimum embedding and transmitting analog audio, digital video and RS-232 control on a single HDMI cable
9. The Transmitter shall contain and a minimum the following connectors:
   a. HDMI
   b. 3.5 mm stereo audio
   c. RS-232 captive screw connector
10. The Transmitter shall be:
    a. Extron DTP HDMI 4K 230Tx

B. Passive HDMI Input (Wall Plate)

1. The wall plate shall be a single-gang decora style wallplate
2. The wall plate shall be a minimum of HDCP 2.2 compliant
3. The wall plate shall be capable of passing EDID information
4. The wall plate shall be capable of signal transmission for up to 230 feet
5. The wall plate shall support HDMI 1.4 and HDMI 2.2
6. The wall plate shall contain and a minimum the following connectors:
   a. HDMI
7. The wall plate shall be:
   a. Liberty AV Single Gang Wall Plate
8. Coordinate faceplate color with Architect

C. HDBaseT Receiver (Rack Mount)

1. The Receiver shall be rack-mountable
2. The Receiver shall be a minimum of HDCP 2.2 compliant
3. The Receiver shall be capable of reading EDID information
4. The Receiver shall support HDMI 1.4 and HDMI 2.2
5. The Receiver shall support the following resolutions:
   a. 1920x1080 @ 60 Hz
   b. 2560x1600 @ 60 Hz
   c. 4096x2160 @ 30 Hz (DCI 4K)
   d. 3840x2160 @ 30 Hz (UHD 4K)
   e. 3840x2160 @ 60 Hz (4:2:0 chroma subsampling)
6. The Receiver shall support up to 12 bit color depth
7. The Receiver shall be capable of at a minimum receiving and deembedding analog audio, digital video and RS-232 control
8. The Receiever shall contain and a minimum the following connectors:
   a. HDMI
   b. 3.5 mm stereo audio
   c. RS-232 captive screw connector
9. The Receiver shall be:
   a. Extron DTP HDMI 4K 230 Rx

D. HDMI Scaling Receiver

1. The Receiver shall be mounted behind the receiving device
2. The Receiver shall be a minimum of HDCP 2.2 compliant
3. The Receiver shall be capable of reading and passing EDID information
4. The Receiver shall support HDMI 1.4 and HDMI 2.2
5. The Receiver shall support the following resolutions:
   a. 1920x1080 @ 60 Hz
   b. 2560x1600 @ 60 Hz
   c. 4096x2160 @ 30 Hz (DCI 4K)
   d. 3840x2160 @ 30 Hz (UHD 4K)
   e. 3840x2160 @ 60 Hz (4:2:0 chroma subsampling)
6. The Receiver shall support up to 12 bit color depth
7. The Receiver shall be capable of at a minimum receiving and deembedding analog audio, digital video and RS-232 control
8. The Receiver shall contain at a minimum the following connectors:
   a. XTP Input
   b. LAN
   c. Line Level stereo audio
   d. RS-232
   e. Relay
9. The Receiver shall be:
   a. Extron XTP SR HD 4K

E. USB Extender

1. The Extender Shall have the following features:
   a. USB host support: xHCI (USB 3.0), EHCI (USB 2.0), OHCI/UHCI (USB 1.1)
   b. USB data rates:

1) Low speed (1.5 Mbps), full speed (12 Mbps), high speed (480 Mbps)

c. USB host — Tx units
1) Number/signal type: 1 USB
2) Connectors: 1 female USB type B
3) Maximum built-in USB hubs: 2
4) Minimum built-in USB hubs: 0
5) Optional built-in USB hubs: Peripheral emulation enabled: 1
6) 1:n network pairing enabled: 1

d. USB device ports — Receiver
1) Number/signal type: (1) 4-port, USB hub
2) Connectors: 4 female USB 2.0 type A
3) Maximum built-in USB hubs: 1
4) Minimum built-in USB hubs: 1
5) Available USB power: 500 mA per port

e. Interconnection between transmitter and receiver
1) Connectors: 1 female RJ-45 per unit
2) Termination standards: TIA 568B

f. Signal transmission distance
1) Point to point: Up to 330' (100 m)
2) Over the network: Up to 1980' (600 m)

g. Network
1) Protocol: Ethernet
2) Transport: TCP/IP, UDP
3) All supported: IPv4, UDP, DHCP, Unicast
4) Standards: IEEE 802.3u (100Base-T), IEEE 802.3ab (1000Base-T)
5) IP Configuration: Static IP (default) or DHCP

2. The Transmitter/Receiver shall be:
a. Extron USB Extender Plus T/R

F. PTZ Conferencing Camera

1. Camera shall be mounted as indicated on the drawings. Provide any additional hardware as indicated.
2. The Camera shall support the following resolution:
a. 1920x1080 @ 60 Hz
3. The Camera shall contain at a minimum the following connectors:
a. RS-232
b. USB 2.0
c. HDMI Out
d. LAN
e. DC12V
4. The Camera shall contain at a minimum the following features:
a. Sensor 1/2.8” HD CMOS
b. Optical Zoom 10X, f = 4.7 ~ 47 mm
c. Viewing Angle 6.43° (telephoto), 60.9° (wide-angle)
d. Effective Pixels 2.07 MP
e. Focus Settings Auto / Manual
f. AV F1.6 – F3.0
g. Minimum Illumination 0.5 lm, F1.8 with Automatic Gain Control ON
h. Signal-to-Noise Ratio (SNR) > 55 dB
i. Control Protocol VISCA/Pelco-D/Pelco-P

j. Pan Rotation ±170°
k. Tilt Rotation -30° ~ +90°
l. Pan Control Speed 0.1 – 180° / sec
m. Tilt Control Speed 0.1 – 80° / sec
n. Integrated IR sensor and manual remote control

5. The Camera shall be:
   a. Lumens VC B30U or equal by Atlona, Huddlecam, Vaddio
   b. Provide all required hardware to ceiling or wall mount as indicated on plans.

G. Document Camera

1. Provide a document camera with the following minimum specifications:
   a. Total Pixels 4224 x 3156 (13MP)
   b. Output 1080p Full HD
   c. 10x optical zoom, 8x digital zoom
   d. Live video frame rate of 60 fps.
   e. Front panel controls with option for computer control via bundled software.
   f. USB 2.0 interface with bundled software for video control, capture, edit and save functions.
2. The document camera shall be:
   a. Hovercam HCS8+

H. Presentation Switcher/Control Processor

1. The Presentation Switcher/Control Processor shall be rack mountable
2. The Presentation Switcher/Control Processor shall be capable of receiving and transmitting 4K content
3. The Presentation Switcher/Control Processor shall utilize the following inputs and outputs:
   a. HDMI In (4)
   b. HDMI Out (4)
   c. Audio In (4)
   d. Audio Out (4)
   e. 70V Speaker Out
   f. LAN
4. The Presentation Switcher/Control Processor shall utilize the following control methods:
   a. RS-232
   b. IR
   c. Relay
   d. Ethernet
5. The Presentation Switcher/Control Processor shall support bidirectional communication via the serial port.
6. The Presentation Switcher/Control Processor shall be:
   a. Extron IN1808 xi IPCP Q MA70

I. Audio Visual Control Panel (Touch Screen)

1. The Control Panel shall be Tabletop/Wall Mount
2. The Control Panel shall have an ethernet connection
3. The Control Panel shall be capable of being powered via PoE
4. The Control Panel shall have a screen size of 10”
5. The Control Panel shall be:

a. Extron TLP Pro 1025T
6. Coordinate Control Panel color with Architect

J. Ceiling Mounted Speakers

1. The speaker shall be a two-way speaker system
2. The speaker shall meet or exceed the following performance criteria
   a. Frequency Response: 68 Hz – 18 kHz
   b. Coverage (Conical) 110 degrees
   c. Power Handling: Tap settings
      70 V input 16 W, 8 W, 4 W, 2 W, 1 W, null (bypass 8 ohm direct connection)
   d. Sensitivity (1W/1m): 86 dB
   e. Nominal Impedance: 8 Ohm
3. The speaker shall be:
   a. Biamp DX-IC6

K. Beam tracking Microphones

1. The microphone shall be ceiling mounted
2. The microphone shall meet or exceed the following performance criteria:
   a. Microphone Technology: 16-Element Digital Array
   b. Frequency Response (150 Hz - 16 kHz): ± 3dB
   c. Polar Pattern: Active Beamformed
   d. SNR (at 1kHz, 94dBSPL A-Weighted): > 76dB
   e. Maximum SPL (at < 1% THD): 109dB
   f. Dynamic Range (THD+N < 1%): 92dB, A-Weighted
   g. Indicators: Mute Indicator (Green/Red LED)
   h. Digital Interface: Custom/Proprietary
   i. Connector: RJ-45 (cable length 6.6 feet [2 meters])
   j. Overall Dimensions
      1) Height (excluding ceiling mount): 0.7 inches (17 mm)
      2) Diameter: 5.9 inches (150 mm)
      3) Weight: 0.7 lbs (340 g)
   k. NETWORK BOX
      1) Connectors: Three RJ-45: one between TCM-X network box and switch, one between the network box and microphone, the other between TCM-X network box and TCM-XEX
   l. Power: PoE (IEEE 802.3at Class 3, 15.4W)
   m. Environmental
      1) Ambient Operating Temperature Range: 32 - 104° F (0 - 40° C)
      2) Humidity: 0-95% relative humidity (non-condensing)
      3) Altitude: 0-10,000 ft (0-3000m) MSL
   n. Compliance:
      1) FCC Part 15B (USA)
      2) UL and C-UL listed (USA and Canada)
      3) Evaluated to the requirements of UL 2043 and is suitable for use in air handling spaces
3. The microphone shall be:
   a. Primary: Biamp Parle TCM-X AVB Beamtracking Ceiling Microphone
   b. Secondary: Biamp Parle TCM-XEX AVB Beamtracking Ceiling Microphone
   c. Provide Biamp TC5 AVB Network Switch for connection of Microphones to DSP.

L. AVB Network Switch

1. The 26 Port AVB Network Switch shall feature the following:
   a. 1 Gbps RJ-45 ports
   b. Two 10G SFP+ Modules supporting AVB and Dante
   c. Front panel LEDs indicate port connections, device status, and fault conditions
   d. Fault reporting and device monitoring supported in SageVue™
   e. Out-of-the-box compatibility with Tesira conferencing products
   f. External power supply
   g. CE marked, UL listed, and RoHS compliant
   h. Covered by Biamp Systems' five-year warranty
   i. AVB License shall be included.
2. The AVB Network Switch shall be:
   a. Provide Biamp NMS-NG26GPX-AVB AVB Network Switch for connection of Microphones and other equipment to DSP as indicated on the drawings.

M. Assistive Listening System: Provide an assistive listening system as indicated on the plans, with the required quantity of receivers as specified herein for deployment as needed by the Owner:

1. Stationary FM transmitter capable of broadcasting on 3 wide band channels. The transmitter shall have an SNR of 62 dB or greater. The output power shall be adjustable to quarter, half or full. Channel tuning shall be capable of being locked. The device shall have an audio frequency response of 50 Hz to 15k Hz, ± 3 dB at 72 MHz. It shall have two mixing audio inputs. The device shall have the following audio controls: input level, mix level and an adjustable 2kHz shelf filter.
   a. The Williams Sound model IR T2 is specified. Provide with a rack mount kit and a model universal antenna kit designed to locate the antenna outside of the equipment cabinet.
2. Personal receivers with both dual earbuds and a lightweight ear speaker. The FM receiver shall be capable of receiving on 3 wide and narrow band channels with a SNR of 62 dB or greater. The device shall have an audio frequency response of 50 Hz to 15 KHz, ±3 dB at 72 MHz. The device will incorporate a stereo headset jack that allows the user to plug in either a mono or stereo headset and listen to the audio normally. The receiver shall incorporate automatic battery charging circuitry for recharging batteries.
   a. The Williams Sound model PPA R37N FM receiver is specified. Provide (8) Receivers, (8) EAR 022 surround earphones, (8) BAT 026-2 AA rechargeable NiMH batteries, and (2) NKL Series Neckloops.
3. Provide a quantity of (2) CHG Series PRO Unit Drop in Charger/Carrying Cases with removable lid.

A. Audio Digital Signal Processor

1. The Audio Digital Signal Processor shall be a multi-channel, software-controlled (RS-232/LAN interface to external computer) multi-function unit incorporating the following functions:

a. 128 x 128 channels of AVB
b. 12 mic/line level inputs with AEC, 8 mic/line level outputs
c. Gigabit Ethernet port
d. RS-232 serial port
e. 4-pin GPIO
f. 2-line OLED display with capacitive-touch navigation
g. Rack mountable (1RU)
h. System configuration and control via Ethernet
i. Internal universal power supply
j. SIP VoIP interface via RJ-45 connector
k. Signal processing via intuitive software allows configuration and control for signal routing, mixing, equalization, filtering, and delay
l. CE marked, UL listed, and RoHS compliant
m. Covered by Biamp Systems' five-year warranty
n. Compliant with the US Trade Agreement Act (TAA)

2. The DSP shall meet or exceed the following performance criteria:
   a. Frequency Response:
      1) 20Hz to 20kHz, +4dBu output: +0.25 dB/-0.5 dB
   b. THD+N (22Hz to 22kHz):
      1) 0dB gain, +4dBu input: < 0.006%
      2) 54dB gain, -50dBu input: < 0.040%
   c. EIN (no weighting, 22Hz to 22kHz): < -125dBu
   d. Dynamic Range (in presence of signal)
      1) 22Hz to 22kHz, 0dB gain: > 108dB
   e. Input Impedance (balanced): 8kΩ
   f. Output Impedance (balanced): 207Ω
   g. Maximum Input: +24dBu
   h. Maximum Output (selectable):
      1) +24dBu, +18dBu, +12dBu,
      2) +6dBu, 0dBu, -31dBu
   i. Input Gain Range (6dB steps): 0-66dB
   j. Overall Dimensions:
      1) Height: 1.75 inches (44 mm)
      2) Width: 19.0 inches (483 mm)
      3) Depth: 10.5 inches (267 mm)
      4) Weight: 8 lbs (3.63 kg)
   k. Phantom Power: +48VDC (7mA/input)
   l. Crosstalk, channel to channel, 1 kHz:
      1) 0dB gain, +4dBu input: < -85dB
      2) 54dB gain, -50dBu input: < -75dB
   m. Sampling Rate: 48kHz
   n. A/D - D/A Converters: 24-bit
   o. Power Consumption:
      1) 100-240VAC 50/60Hz: < 35W
   p. USB:
      1) Bit Depth: 16- or 24-bit
      2) Number of Channels: up to 8
      3) Sample Rate: 48kHz

3. The DSP shall be:
   a. Biamp TesiraFORTE AVB CI

B. Audio Amplifier

1. The Audio Amplifier shall meet or exceed the following performance criteria:
   a. Audio
      Voltage gain
      XPA 2001-70V 57x (35 dB)
      Stereo channel separation >75 dB @ 1 kHz
      CMRR 75 dB @ 1 kHz (typical)
   b. Audio input
      Number/signal type 1 stereo or 2 mono, balanced/unbalanced
      Connectors (1) 3.5 mm captive screw connector, 5 pole
      Impedance >10k ohms unbalanced/balanced, DC coupled
      Nominal level +4 dBu (1.23 Vrms), balanced
      Maximum level +20 dBu (7.75 Vrms), balanced
      Input sensitivity +4 dBu (1.23 Vrms) if driven by one input
      -2 dBu (0.615 Vrms) if both inputs are summed
      Input signal detection threshold -40 dBu ±3 dB, balanced
      NOTE 0 dBu = 0.775 Vrms, 0 dBV = 1 Vrms, 0 dBV ≈ 2 dBu
   c. Audio output
      Number/signal type
      Connectors (1) 5 mm screw lock captive screw connector, 2 pole
      Load impedance
      Amplifier type Class D
      Output power
      300 watts rms, 70 V, 1 kHz, <0.1% THD
      Frequency response 20 Hz to 20 kHz, ±1 dB
      THD + Noise <0.1% @ 1 kHz at 3 dB below clipping
      S/N 100 dB, 20 Hz - 20 kHz, unweighted
      Damping factor
      70V >100 @ 25 ohms
      High pass filter 80 Hz, 12 dB per octave rolloff (switch selectable)
   d. Control/remote — amplifier
      Control port (1) 3.5 mm captive screw connector, 5 pole
      Pin configurations
      DC volume control (analog) Pin 1 = +10 VDC, 50 mA (max.), pin 2 = volume/mute (variable voltage), pin 3 = GND
      Volume control voltage range 0 V (mute) to 10 V (maximum volume)
      Standby power control (contact closure) Pin 4 = GND, pin 5 = standby
   e. General
      Power supply Internal
      Input: 100-240 VAC, 50-60 Hz
      Power consumption and thermal dissipation
      Ambient temperature/humidity Storage: -40 to +158 °F (-40 to +70 °C) / 10% to 90%, noncondensing
      Operating: +32 to +122 °F (0 to +50 °C) / 10% to 90%, noncondensing
      Cooling Convection, no vents, with internal heat sinks
      Protection Clip limiting, thermal, short circuit, DC output
      Indication Limiter/Protect LED indicates the onset of clip limiting, thermal cycling, or a short circuit
   f. Mounting
      Rack mount Yes, with optional 1U rack shelf

Enclosure type Metal
Enclosure dimensions 1.7" H x 8.7" W x 9.5" D (1U high, half rack wide) (4.3 cm H x 22.1 cm W x 24.1 cm D)

g. Product weight 2.5 lbs (1.1 kg)

2. The Amplifier shall be:
   a. Biamp Voltera A 300.2

C. Rack Mounted Surge Eliminator

1. The Rack Mounted Surge Eliminator shall incorporating the following functions:
   a. Input: (1) NEMA 5-20P, 120V/20A
   b. Output: (5) NEMA 5-15R, (4) NEMA 5-20R, 120V
   c. Load Rating 15 Amps @ 120 volts
   d. Power Requirements (no load) 15 watts
   e. Surge Let-Through Voltage (6000-volt surge) 0 volts
   f. UL 1449 Adjunct Classification Test Results1000 surges, 6000 volts, 3000 amps, B3 pulse
   g. Measured suppressed voltage 170 volts, no failures
   h. Federal Guidelines Grade A, Class 1, Mode 1 (CID A-A-55818)
   i. EMI/RFI Filter, Normal Mode (50-ohm load) 40 dB @ 100 kHz; 50 dB @ 300 kHz; 50 dB @ 3 MHz; 50 dB @ 30 MHz
   j. EMI/RFI Filter, Common Mode (50-ohm load) 18 dB @ 300 kHz; 30 dB @ 1 MHz; 50 dB @ 5 MHz; 50 dB @ 20 MHz
   k. Maximum Applied Surge Voltage 6000 volts
   l. Maximum Applied Surge Current Unlimited, due to current limiting
   m. Maximum Applied Surge Energy Unlimited, due to current limiting
   n. Endurance (C62.41-1991 Category B3 pulses) 1 kV>500,000; 3 kV>10,000; 6 kV>1000
   o. Undervoltage Shutdown 90 volts (resume at 100 v)
   p. Overvoltage Shutdown 145 volts (resume at 135 v)
   q. Maximum Load Inrush Current During Power-up 1000 Joules
   r. Remote Turn-on Applied Voltage Range 5 to 30 volts DC
   s. Contact Closure 1.5 mA
   t. 5 V DC Applied Voltage 0.1 mA
   u. 12 V DC Applied Voltage 1.5 mA
   v. 24 V DC Applied Voltage 5.0 mA
   w. Auxiliary Relay Contact Rating 30 Volts at 1 Amp
   x. LED Output 12 volts DC, maximum 20 mA (resistor required)
   y. Dimensions 1.75" H x 19" W x 10.5" D (4.5 x 48.3 x 26.7 cm)
   z. Weight 11 lbs (5 kg)
   aa. Temperature Range 5º to 35º C
   bb. Humidity Range 5% to 95% R.H., non-condensing
   cc. Agency Listings ETL and cETL certified to (UL 1449; CSA C22.2 No.8-M1986, R2000)
2. The Surge Eliminator shall be:
   a. SurgeX SX1120RT or equal

2.3 Wiring

A. Control Wiring

1. Provide low voltage control wiring for RS-232 control of Flat Panel Monitors.
2. Where RS-232 cabling distances exceed industry standards or where otherwise required, provide repeaters/line conditioners.
3. Provide low voltage control wiring for infra-red control of rack mounted devices as required.

B. Video and Audio Cable - Installed

1. Digital Video Cable
   a. HDMI Pre-terminated Assembly: Provide high-quality HDMI cables, tested and verified to support all digital video resolutions up to 4K/60 and computer resolutions up to 3840 x 2160 over the actual length of the specific cable. It shall additionally support all digital audio formats including Dolby True HD and DTS-HD Master Audio. The assembly shall be covered by a lifetime warranty.
   b. Physical characteristics:
      1) 24k gold-plated connectors
      2) 24 AWG high-purity, oxygen-free conductors
      3) High-density triple shielding for rejection of EMI and RFI
      4) UL Listed, CL2P, CL3P and CMP certified
   c. Approved manufacturers: Atlona, Crestron, Extron, Covid
   d. HDMI Extender: In those instances where the HDMI cable length exceeds the maximum length necessary to achieve the specified resolution(s), an HDMI extender shall be utilized to restore signal strength. The unit shall be located at the display (sink) and either powered via the HDMI cable from the source or powered via external low-voltage power supply. The extender shall be compatible with the latest HDMI 2.1 (4K60Hz) and support DDC transmission of pass-through EDID and HDCP information.
      1) Approved products: Extron HDMI 101, Covid HDMI 91x1, Atlona AT HDMI-11s, Geffen Super Booster Plus.
2. Stereo Audio/Serial Control Cable
   a. Stereo Audio Cables - 22 gauge, tinned, stranded copper, 2 pair w/individual shields and drain wire under a common jacket.
   b. Cable By Extron, Belden, West Penn, Covid or Liberty.
3. Digital Video Cable – Provide where shown for twisted pair cable digital media solutions. Twisted pair cable shall have the following qualities:
   a. High-bandwidth/low crosstalk shielded 4-twisted pair (STP) cable with overall jacket.
   b. Crestron Electronics or equal by, Extron, Belden, West Penn or Covid.
4. Fiber Optic – Provide fiber optic cable where called out on drawings.

C. Audio/Visual Interconnection Cables

1. Provide all associated A/V patch cables for each equipment item for a fully operational system. Flat Panel Monitors, etc. shall be supplied with all patch cables required to fully connect with local outlets and interconnect with related equipment as specified and as shown on drawings. All outlets must also be provided with a patch cable for every A/V jack.
2. At a minimum, all items of equipment shall be supplied with a patch cable for each type of input. In some instances, it may be required of the contractor to provide the appropriate adaptors depending on input/output configurations of specific items of equipment.
3. The A/V Contractor shall be responsible for final dressing of all patch cables at each item of equipment to provide a neat and orderly appearance. Plastic Tie Wraps shall not be allowed. Hook and Loop type wraps shall be acceptable.

4. Patch cable lengths shall be sized to provide sufficient serviceability yet maintain a neat and workmanlike appearance.

2.4 Cables, Connectors and Plates

A. Audio/Video Jacks

1. HDMI – Type A feed-through, panel mount connector.
2. Extron DTP
3. USB
4. Speaker
5. AVB

B. Jackplates

1. Outlet faceplates shall be custom-fabricated, stainless steel.
2. Each and every jack shall be labeled to corresponding patch panel and port. Each and every audio/video jack shall be labeled to indicate function. Coordinate labeling scheme with Owner. Labels shall be engraved and backfilled or adhesive laminated plastic. P-touch labels or labels applied with pens or markers are not acceptable.
3. Data jacks, where shown integrated into custom jackplates, shall be provided by the structured cabling provide and shall adhere to the provided channel solution. Custom cut-outs shall be coordinated with the structured cabling contractor to provide and exact fit for the RJ-45 module as provided, labeled and terminated by the structured cabling installer.
4. Outlets to be installed in floor boxes/poke-thrus to be installed in faceplates, compatible with floor box / poke-thru make / model and secured within floor box / poke-thru. The use of loose or un-mounted jacks shall not be acceptable. Where floor box / poke-thru to determine specific requirements for jacks and coverplate.
5. Refer to drawings for arrangement of various workstation outlets including jack types and quantities within each outlet type. All voice/data/video/audio and fiber jacks indicated in the faceplate shall be deemed included in this specification unless specifically noted otherwise.
6. Acceptable custom plate manufacturers: Ace Backstage, Panel Crafters, ProCo or RCI Custom

PART 3 - EXECUTION

3.1 General Installation

A. Equipment shall be furnished and installed in accordance with manufacturer's recommendations in compliance with all local, city, state and national codes.

B. Provide all hardware, framing members, etc. as required for mounting equipment. Coordinate all structural mounting points and locations and load requirements with Architect/General Contractor.

C. All penetrations in smoke or firewalls shall be sealed with fire stop rated for this purpose.

D. The installation of all work shall be neat and of professional quality. Cooperate with other trades in order to achieve well-coordinated progress and satisfactory final results. Execute without claim for extra payment minor moves or changes in equipment locations to accommodate equipment of other trades or the architectural symmetry of the facility.

E. Installation shall follow industry standard wiring and installation practice, and shall meet or exceed industry standards for such work, with particular attention given to any installation instructions in Parts 1 and 2 of these Specifications.

F. Equipment shall be secured firmly with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor of at least three unless otherwise stated.

G. All equipment shall be installed so as to provide reasonable safety to the operator.

H. All overhead or wall-mounted speaker systems shall be supported from the building structure utilizing the materials and methods recommended by the speaker manufacturer and good rigging practices, providing a load-rated safety factor of six (6). All required installation material and labor shall be deemed included in these specifications.

I. Furnish the system to facilitate expansion and servicing using modular, solid-state components. All equipment shall be designed and rated for continuous operation and shall be UL listed where applicable, or manufactured to UL standards.

J. It will be the responsibility of this contractor to provide all programming of the room control system to incorporate the functionality the owner requires.

K. In addition to the GUI provided the technology systems contractor will provide an Ethernet based executable GUI for interfacing to the system.

L. Technical Systems Manual, custom-written by the Contractor, for the purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventative maintenance procedures. This manual shall include descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.

M. Provide capability for mute override upon activation of the building fire alarm system.

3.2 Wiring Installation

A. Observe proper circuit polarity and loudspeaker wiring polarity. No cables shall be wired with a polarity reversal between connectors with respect to either end. Special care shall be taken when wiring microphone cables, to ensure that uniform polarity is maintained. Balanced audio connectors shall be wired with shield at Pin #1, hi/positive at Pin #2.

1. All audio circuits shall be balanced and floating, except as noted in the specifications or directed by Heapy Engineering at the time of final equalization and testing. Shields of audio cables installed between active interconnected equipment components shall be grounded at the sending end only.
2. All cables shall be installed in conduit except above accessible ceilings, where they shall be installed utilizing J-hooks or bridle rings on minimum 5 ft. centers or cable tray, where available.
3. Separate conduits and/or cable harnesses shall be maintained for cables in the following categories
   a. Levels below -20 dBm (microphone).
   b. Nominal line levels from -20 dBm to +30 dBm (line).

c. Loudspeaker
d. Control
e. Power
f. Video

4. Cable management system shall be secured to building structure utilizing manufactured approved methods and hardware. Cable management system support components shall be designed with wide support surfaces that do not cause cables to be bent, crushed or otherwise deformed when installed within component loading parameters. Cable management system shall meet UL standards and be UL labeled. Utilizing elements of the building's structure such as beams, joists, etc. to hang cable from will not be acceptable.
5. Group and route all cables within equipment cabinets according to type and function and separate according to signal levels. All cables shall be continuous lengths without splices.
6. Cables shall be handled and installed with extreme care. Tie wraps shall **loosely** hold cables; **do not over-tighten**. Cables shall have sweeping bends and shall have a maximum bending radius at any point in the installation of not less than 4 times the outer diameter of the cable. The cable manufacturer's recommended bending radius and maximum pulling tensions shall be strictly adhered and shall not be exceeded. Failure to comply will result in the removal and replacement of affected cable at no additional cost to the Owner.
7. Cable pathways shall provide the following minimum clearances (parallel or perpendicular)
   a. Motors and transformers – 48 inches.
   b. Conduit and cable used for electrical power distribution – 12 inches.
   c. Fluorescent lighting – 5 inches.
   d. Power lines up to 2kVA – 5 inches.
   e. Power lines over 5kVA – 24 inches.
   f. Hot water/steam lines - Bare –18 inches, Insulated – 6 inches.
8. All cabling installed in underground conduit installations shall be outdoor rated cables, acceptable for use by the manufacturer in underground applications.
9. All system wire shall be terminated by approved soldered or mechanical means. No unterminated wire ends will be accepted. Heat shrink type tubing shall be used to insulate and dress the ends of all ground or drain wires.
10. All solder joints and terminations shall be made with rosin-core silver solder. No lead based solder shall be accepted.
11. Mechanical connections shall be made using approved connectors of the correct size and type for the connections. Wire nuts are not acceptable except in the case of distributed, constant-voltage speaker systems.

3.3 Programming

A. AV Distribution System and touch panel controller shall be programmed as described herein and as required by owner. Contractor to develop system programming through a series of meetings, storyboard submittals and a final virtual run-through prior to programming. Programming shall be submitted to Heapy Engineering prior to application for approval.

B. Program flow drawings shall be submitted by the contractor for review prior to any programming taking place. No fewer than three meetings shall take place regarding program flow and touch panel interface prior to any programming being started.

C. Program flow review with follow-up email communication and approval or in-person meetings as necessary.

D. Technical review of touch panel (mock-up touch panel will be required at this meeting).

E. End-user touch panel review of mock-up touch panel

1. Present must be the AV Vendor Engineer and an Owner's representative.
2. End users will also be present at the end-user review of mock-up touch panel.

F. Access to the Owner's network for programming shall be coordinated with C&IT. Any request for this type of access should be submitted in writing no fewer than ten (10) business days prior to need.

G. JPEG screen shots will be required of the touch panel once the design is final so that the end-user may begin to create a user instruction guide.

H. Touch panel controller shall be programmed as described herein at a minimum, with full comprehensive programming coordinated with the owner. Programming shall be submitted to the Owner as outlined in Supplemental Instructions below.

I. Programming - Touch panel controller shall be programmable with graphic page as required to offer controls for A/V equipment connected to the system. Unit shall be programmed per the owner's requirements to provide the following controls at a minimum:

1. There shall be a welcome page with simple system on/off features and custom Owner logo and a home page with the most often used control features. For bidding purposes, plan for a minimum of 10 user pages with 5 additional technician level pages.
2. Controls for system on/off, system volume and mute, monitor on/off, and user "blackout" shall be accessible as fixed buttons.
3. There shall be provided full component control of the DocCam, Switchers/Scalers, Matrix Switchers, Display device and DSP control (see below)
4. DSP control shall allow for system-wide mute and volume control.
5. There shall be Technician level control pages, password protected that allow complete access to all component features including system menus.

3.4 Tests

A. Upon completion of installation and satisfactory testing of system by Contractor in presence of the equipment supplier, the Contractor shall test the system in the presence of the Owner and the Engineer to demonstrate satisfactory performance.

B. System shall be tested by and a certificate of inspection shall be furnished by a qualified manufacturer's representative or equipment vendor; Submit report indicating result to the Engineer.

C. A qualified technical representative of the system contractor shall do systems acceptance testing. Installation must be complete in all respects before acceptance testing. Acceptance testing and training must be scheduled on separate dates to allow time for corrections, if necessary. Once all functions and devices within the system have been adequately demonstrated to be working properly, a complete owner's manual will be presented to the Owner's agent. It shall contain a comprehensive list of all supplied equipment, a complete point-to-point system wiring diagram with "AS BUILT" wire numbers indicated, details of hook-up connections including build-out devices (active and passive), systems control settings record,

the final test results including plotted frequency response curves, operation and maintenance manuals for each active device including schematic diagrams and parts list. A thoroughly completed commissioning checklist (re: InfoComm's AV Installation Handbook Appendix J: Audiovisual Systems Commissioning Tests Checklist) shall be included with the Owner's Manual.

D. The Contractor shall be prepared to verify the performance of any portion of the system by demonstration, listening tests and/or instrument measurements.

E. Measurement of frequency response, distortion, noise, or other characteristics shall be performed (or a demonstration test requested) if deemed necessary to determine proper operation.

F. The Contractor shall make additional mechanical and electrical adjustments within the scope of the work and which are deemed necessary by the Engineer as a result of acceptance tests.

G. Test Reports and Certification: Submit results of all tests conducted above and certification that the installation is complete and ready for checkout as specified.

3.5 Identification/Labeling

A. Contractor shall identify all major items of equipment and tag all cables with machine printed labels to denote equipment served. Cables shall be tagged at both end and at each point where the cable is administered.

B. The contractor shall be responsible for applying a permanent label to each cable to indicate source and destination.

C. All labeling and recording shall be approved by the Owner and the Engineer prior to application.

3.6 Training

A. Provide step-by-step user instructions identifying operator controls for normal use operations. This shall be included with the O&M manuals.

B. The contractor shall arrange for a total of sixteen (16) hours for end user training on the various A/V Systems. This training shall be planned and scheduled with the Owner. Training plan shall be pre-approved by the Engineer/Architect and shall include a review of the proposed syllabus.

C. Video record the training sessions and provide an electronic copy to the Owner.

3.7 O & M Manuals

A. Copies of all approved shop drawings with the Engineer’s stamp.

B. Owner’s manuals for every item of equipment when available from the manufacturer. These shall be the technical manuals provided by the manufacturer and shall not consist of generic sales brochures. Technical manuals shall provide complete specifications for the equipment as well as complete operating, maintenance, troubleshooting and product repair/replacement information. Where available only in electronic format, the contractor may provide a CD with

electronic versions of Owner's manuals. CDs containing electronic versions of Owner's manuals must contain the proper software viewers for each document type.

C. Technology drawings updated with final as-built information. This shall be in the form of a complete set of Technology drawings with as-built information indicated in colored pen based upon actual field conditions.

D. System schematic and block diagrams for every system updated with final as-built information. These drawings shall define the exact arrangement of each system including wiring configuration, device locations and cable types.

E. Rack elevations for all systems with rack mounted equipment.

F. System Operating Instructions: Provide a clear and concise description of operation which gives, in detail, the information required to properly operate the equipment and system.

G. Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the Certificate of Warranty, signed by both parties.

H. Provide statement of warranty with O&M Manuals.

3.8 Warranty

A. Warrant all workmanship, equipment, material and software entering into this contract for a period of three (3) years from date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect or Construction Manager. Any materials or equipment proving to be defective during the warranty period shall be made good without expense to the Owner. Provide a statement of this warranty with the O & M Manuals.

B. During the warranty period, report to the site and repair or replace any defective materials or workmanship without cost to the Owner. Warranty service shall be rendered within 24 hours after request by the Owner. Equivalent replacement equipment shall be temporarily provided when immediate on-site repairs cannot be made.

C. Where warranties on individual pieces of equipment exceed three (3) years, the guarantee period shall be extended to the warranty period of the particular items.

D. After completion of the work, the Contractor shall submit a Certificate of Warranty, stating commence and expiration dates and conditions of the warranty, for signature of both participating parties. Incremental warranties for complete portions of the work may be negotiated at the discretion of the Owner, if delays occur beyond the control of the Contractor.

END OF SECTION

27 41 19
VIDEO DISPLAY EQUIPMENT

PART 1 - GENERAL

1.1 Scope of Work

A. The work described by this section includes the furnishing of all components, materials, equipment, installation and technical labor and the performance of all operations necessary for the complete installation of an audio/visual system in operating condition as indicated on the drawings and/or specified herein.

B. Included in the Scope of this Section:

1. Licenses, permits as may be applicable
2. Provision of submittal information
3. Installation in accordance with contract documents, manufacturers' recommendations and applicable codes
4. Programming and configuration of control and signal processing software
5. Testing and adjustments, including documentation thereof
6. Provision of manuals
7. Maintenance and warranty services

C. Applicable References:

1. National Electric Code (NEC)
2. Underwriters Laboratories (UL)
3. Infocomm International AV Installation Handbook –2nd Edition
4. Telecommunications Distribution Methods Manual (TDMM)

D. In general, the conduit and/or cable tray, junction boxes, electrical power circuits and outlets and terminal cabinets, as required for a complete operating system, shall be furnished and installed by the Electrical Contractor under a separate contract. The entire responsibility for the system, its installation, operation and function shall be that of the Systems Contractor.

1.2 Description of Work

A. Work consists of new A/V Display Equipment including:

1. Television/Flat Panel Monitors complete with wall mounting hardware and connection to the local AV Distribution Systems as detailed on the drawings and as specified herein.
2. Interactive / Non-Interactive monitors located on the Podiums and connection to the local AV Distribution Systems as detailed on the drawings and as specified herein..

B. All material and/or equipment necessary for proper operation of the system, not specified or described herein, shall be deemed part of these specifications.

1.3 Quality Assurance

A. All system components shall be UL listed.

B. Installation shall be in compliance with the National Electric Code and all other applicable codes.

C. All equipment described herein or otherwise required to perform the specified system functions shall be a regular product line, produced by the system manufacturer.

D. All materials furnished under this contract shall be new, of highest quality and shall be of a regularly manufactured line, currently in production at the time of installation.

1.4 Contractor Qualifications

A. The A/V equipment package shall be furnished and installed by a contractor who meets all the requirements listed herein. It shall not be acceptable for the A/V contractor to utilize a Subcontractor for any portion of the work, unless the Subcontractor has been approved in writing by the Engineer based upon adherence to the qualifications listed herein.

B. The Contractor shall maintain a fully equipped, factory certified service organization capable of providing full maintenance and service of the installed system within 24 hours. This facility shall be available for inspection by the Engineer.

C. Equipment supplier shall have a service organization within 75 miles of the project site.

D. The Contractor shall employ factory trained service personnel for the service and maintenance of the system.

1.5 Shop Drawings

A. Refer to Section 27 05 01 Basic Communication Requirements.

B. A complete and comprehensive list of materials with quantity, manufacturer, model and part number and reference to the Part 2 specification paragraph number for each item.

C. Manufacturers Data Sheets of all products and cabling, specific to the project. Data sheets shall show the exact parts, with model numbers and options as required and clearly identified.

1. Drawings shall include designations, dimensions, operating controls, electrical requirements, input/output configurations, operating controls, etc.
2. Major components including all sub-assembly components (daughter cards, option cards, etc.) required to perform the specified functions.
3. Any items of equipment which have features and/or functions that deviate from the specifications contained herein, shall have these deviations clearly called out by a separate attachment with the shop drawings specifically listing and detailing the deviation along with a justification. Deviations must be approved specifically in writing.

D. Job specific diagrams.

E. 30x42 floor plans at a scale of not less than 1/8 inches=1 foot-0 inches showing the location of all items of equipment. Drawings shall also indicate each location where electrical power is required, and the specific configuration of that power connection (voltage, plug type, mounting height, etc.)

F. Proposed construction details for all custom fabricated items, including wall plates, interface panels, mounting hardware and systems, and rigging hardware. These details shall show labeling, dimensions and indicate finishes and color selection.

G. Submittals that do not contain all the required information will be REJECTED unless prior approval for partial submittals has been approved.

PART 2 - PRODUCTS

2.1 Product Equivalency

A. Where products are listed with multiple manufacturers, these manufacturers will be approved as equals **if all specified features are provided**. Any equipment not specifically approved in writing prior to the bid date will not be considered regardless of qualifications. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate equipment at the Contractor's expense.

B. Different manufacturers may require various options, accessories, converters, patch cables, etc. to perform the specified features and functions. Therefore, all material and/or equipment necessary for proper operation of the system shall be deemed part of these specifications.

2.2 HDTV Flat Panel Displays

C. Nominal Diagonal as indicated on the drawings, Wide-screen, LED flat panel, high definition display with 16:9 aspect ratio, 3840 x 2160 native display resolution, 60Hz refresh rate.

1. A/V inputs
   a. HDMI 2.1/HDCP
   b. USB
   c. Stereo audio
2. A/V Outputs
   a. Digital Audio (Optical, Coax)
   b. Analog audio – variable line level
   c. Other Inputs/Outputs
   d. RS-232 (Control/Setup/Service)
3. NTSC/ATSC Tuners with Clear QAM must support all FCC compliant analog and digital broadcasts.
4. All functions shall be IR remote controllable.
5. All Units shall be capable of integration with AV Control System.
6. Provide a remote control with each unit.

7. Flat Panel Display make shall be by Sharp, NEC, Samsung, ViewSonic, or equivalent.

D. HDTV monitors shall be "Commercial Grade".

2.3 Podium Mounted Display – Non-Interactive Configuration

A. Basis of Design as indicated on the drawings, Wide-screen, LED flat panel, high definition display with 16:9 aspect ratio, 1920 x 1080 native display resolution, 60Hz refresh rate.

1. A/V inputs
   a. HDMI
   b. DisplayPort
   c. Analog Audio
   d. USB – Monitor shall be configured to be Non-Interactive; USB shall not be connected to OFOI PC.
2. Monitor shall be Planar Helium PCT2235 or equivalent. Monitor shall include tilting desk mount.

2.4 Podium Mounted Display –Interactive Configuration

B. Basis of Design as indicated on the drawings, Wide-screen, LED flat panel, high definition display with 16:9 aspect ratio, 1920 x 1080 native display resolution, 60Hz refresh rate.

1. A/V inputs
   a. DVI-I
   b. USB – Monitor shall be configured to be Interactive and be connected to OFOI PC.
2. Monitor shall be Smart Podium 624 Pro Interactive Pen Display or equivalent. Monitor shall include tilting desk mount.

2.5 Flat Panel Display Mounts

A. Mounts

1. Wall mounts shall be supplied for displays. Provide all required supporting hardware as required by field conditions. Verify structural integrity of mounting location.
2. Wall mounts shall utilize an adjustable minimum 5 degree forward tilt.
3. Wall mounts shall be capable of protruding forward away from the wall for serviceability with all necessary brackets, bracing and hardware to make a complete and fully functioning system.
4. Coordinate location and elevation of wall mounts with Architectural elevations and room furnishings.

5. Mounts shall be by Chief, Peerless, LeGrand AV or equivalent.

2.6 Surge Suppressors (for all display devices): The surge suppressor shall be a compact mountable unit in a magnetic shielding steel enclosure. It shall operate from 120 volts AC and include a separate 3-foot, grounded, 3-wire #18 line cord. There shall be 2 grounded AC receptacles. Overall dimensions shall be 1.75 inches H x 5.31 inches W x 9.06 inches D. Weight shall be 3.4 pounds. It shall have a load rating of 8 amps @ 120 volts. It shall be listed to UL 1449-2 and certified to Federal Grade A, Class 1, Mode 1 Guidelines for powerline surge suppressors. The unit shall provide auto-resetting overvoltage shutdown. There shall be three limiter circuits: a series surge reactor current limiter, a cascaded auto-tracking dual-polarity voltage limiter, and a pulse inverter. The onset clamping voltage shall be 172 volts nominal, and the unit shall have an instant-reacting snubber to protect against fast-rising surges generated within the installation location. The surge suppressor shall have an unlimited Applied Surge Current rating (8 x 20 µs) and shall withstand at least 1000 occurrences of Surge Pulse Voltages up to 6000 volts. Provide a Surgex model SA82 Flatpak for each flat panel monitor and projector. No substitutes.

PART 3 - EXECUTION

3.1 General Installation

A. Equipment shall be furnished and installed in accordance with manufacturer's recommendations in compliance with all local, city, state and national codes.

B. Provide all hardware, framing members, etc. as required for mounting supports.

C. All penetrations in smoke or firewalls shall be sealed with fire stop rated for this purpose.

D. The installation of all work shall be neat and of professional quality. Cooperate with other trades in order to achieve well-coordinated progress and satisfactory final results. Execute without claim for extra payment minor moves or changes in equipment locations to accommodate equipment of other trades or the architectural symmetry of the facility.

3.2 Flat Panel Installation

A. Contractor shall field verify the location of each flat panel with surrounding structural elements and room furnishings at the proposed mounting location to ensure proper installation prior to mounting equipment. Where field conditions will not provide the correct application for the proposed flat panel type/location/mounting method, the contractor shall notify the Engineer/Architect in writing. Notification shall include proposed alternatives for review.

B. Flat panel displays shall be mounted straight, level and true.

C. Contractor shall custom configure the flat panel video/image/setting menus once source equipment and AV system is operational. Flat panel set-up shall be completed and the optimal settings stored for later recall.

D. Programming of flat panels and centralized AV control software including all network assignments, passwords, schedules, etc.

3.3 Tests

A. Upon completion of installation and satisfactory testing of system by Contractor in presence of the equipment supplier, the Contractor shall test the system in the presence of the Owner and the Engineer to demonstrate satisfactory performance.

B. System shall be tested by and a certificate of inspection shall be furnished by a qualified manufacturer's representative or equipment vendor; Submit report indicating result to the Engineer.

3.4 Identification/Labeling

A. Contractor shall identify all major items of equipment and tag all cables with Machine Printed Labels to denote equipment served. Cables shall be tagged at both end and at each point where the cable is administered.

B. The contractor shall be responsible for applying a permanent label to each cable to indicate source and destination.

C. All labeling and recording shall be approved by the Owner and the Engineer prior to application.

3.5 Training

A. Provide step-by-step user instructions identifying operator controls for normal use operations. This shall be included with the O&M manuals.

B. The contractor shall arrange for a total of sixteen (16) hours for end user training on the various A/V Systems. This training shall be planned and scheduled with the Owner. Training plan shall be pre-approved by the Engineer/Architect and shall include a review of the proposed syllabus.

C. Video record the training sessions and provide an electronic copy to the Owner.

3.6 O & M Manuals

A. Copies of all approved shop drawings with the Engineer's stamp.

B. Owner's manuals for every item of equipment when available from the manufacturer. These shall be the technical manuals provided by the manufacturer and shall not consist of generic sales brochures. Technical manuals shall provide complete specifications for the equipment as well as complete operating, maintenance, troubleshooting and product repair/replacement information. Where available only in electronic format, the contractor may provide a CD with electronic versions of Owner's manuals. CDs containing electronic versions of Owner's manuals must contain the proper software viewers for each document type.

C. Technology drawings updated with final as-built information. This shall be in the form of a complete set of Technology drawings with as-built information indicated in colored pen based upon actual field conditions.

D. System schematic and block diagrams for every system updated with final as-built information. These drawings shall define the exact arrangement of each system including wiring configuration, device locations and cable types.

E. Rack elevations for all systems with rack mounted equipment.

F. System Operating Instructions: Provide a clear and concise description of operation which gives, in detail, the information required to properly operate the equipment and system.

G. Provide statement of warranty with O&M Manuals.

3.7 Warranty

A. Warrant all workmanship, equipment, material and software entering into this contract for a period of three (3) years from date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect or Construction Manager. Any materials or equipment proving to be defective during the warranty period shall be made good without expense to the Owner. Provide a statement of this warranty with the O & M Manuals.

B. During the warranty period, report to the site and repair or replace any defective materials or workmanship without cost to the Owner. Warranty service shall be rendered within 24 hours after request by the Owner. Equivalent replacement equipment shall be temporarily provided when immediate on-site repairs cannot be made.

C. Where warranties on individual pieces of equipment exceed three (3) years, the guarantee period shall be extended to the warranty period of the particular items.

D. After completion of the work, the Contractor shall submit a Certificate of Warranty, stating commence and expiration dates and conditions of the warranty, for signature of both participating parties. Incremental warranties for complete portions of the work may be negotiated at the discretion of the Owner, if delays occur beyond the control of the Contractor.

END OF SECTION

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SECTION 284600
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Evidence of designer qualifications.

C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
   11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
   12. Certification by Contractor that the system design complies with Contract Documents.
   13. Do not show existing components to be removed.

D. Evidence of installer qualifications.

E. Evidence of instructor qualifications; training lesson plan outline.

F. Evidence of maintenance contractor qualifications, if different from installer.

G. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test Form," filled out.

H. Operating and Maintenance Data: See Section 017800 foradd; have one set available during closeout demonstration:
   1. Complete set of specified design documents, as approved by authority having jurisdiction.
   2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
   3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
   4. List of recommended spare parts, tools, and instruments for testing.
   5. Replacement parts list with current prices, and source of supply.
   6. Detailed troubleshooting guide and large scale input/output matrix.
   7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
   8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

I. Project Record Documents: See Section 017800 foradd:
   1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
   2. "As installed" wiring and schematic diagrams, with final terminal identifications.
   3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

J. Closeout Documents:
   1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
   2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

1.05 WARRANTY

A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units and Accessories:
   1. Siemens Building Technologies, Inc: www.usa.siemens.com/#sle.
   2. Provide control units made by the same manufacturer.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
   2. Protected Premises: Entire building shown on drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. ADA Standards.
      b. The requirements of the local authority having jurisdiction .
      c. Applicable local codes.
      d. Contract Documents (drawings and specifications).
      e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
   4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
   5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
   6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
   7. Program notification zones and voice messages as directed by Owner.
   8. Fire Command Center: Location indicated on drawings.
   9. Fire Alarm Control Unit: New, located at fire command center.

B. Supervising Stations and Fire Department Connections:
   1. Public Fire Department Notification: By on-premises supervising station.
   2. On-Premises Supervising Station: Existing proprietary station operated by Owner.
   3. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.

C. Circuits:
   1. Initiating Device Circuits (IDC): Class B, Style A.
   2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.

3. Notification Appliance Circuits (NAC): Class B, Style W.

D. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.

B. On-Premises Supervising Station: Include as part of this work all modifications necessary to existing supervising station to accommodate new fire alarm work.

C. Clearly label components that are "Not In Service."

D. Remove unused existing components and materials from site and dispose of properly.

2.04 FIRE SAFETY SYSTEMS INTERFACES

A. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Duct smoke detectors.

B. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

C. Doors:
1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 087100.

2.05 COMPONENTS

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Initiating Devices:
1. Addressable Systems:
a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

C. Notification Appliances:

D. Circuit Conductors: Copper or optical fiber; provide 200 feet (60 m) extra; color code and label.

E. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

F. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.

3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.03 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.
   2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session pre-closeout.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.

D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.04 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

3.05 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

C. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

F. Comply with Owner's requirements for access to facility and security.

END OF SECTION 284600