

PROJECT MANUAL

Roanoke County Parks, Recreation and Tourism Shop Building

Renovation



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5305 Hollins Road Roanoke, Virginia	1. Specifications (Divisions 1 – 27). 2. Asbestos & Lead Inspection Report.
Job Number	
03220077.00	
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Additional Notes	

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SECTION 011000 SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Parks, Recreation, and Tourism Office.
- B. Owner's Name: County of Roanoke Virginia.
- C. Architect's Name: Balzer & Associates.
- D. The Project consists of the following:
 - 1. Renovations to an existing Parks, Recreation, and Tourism Facility, located at 5305 Hollins Rd, Roanoke, VA 24019.
 - 2. Construction of a pole structure on an adjacent parcel to the Parks, Recreation, and Tourism office building.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 005200 - Agreement Form.

1.03 DESCRIPTION OF ALTERATIONS WORK

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

1.04 WORK BY OWNER

- A. Owner will supply and install the following:
 - 1. Equipment indicated as "BY OWNER" in equipment schedules on drawings.
 - 2. Communications Systems: See Electrical drawings & specifications for additional information.
 - 3. Access Control and Security Systems: See Electrical drawings & specifications for additional information.
 - 4. Interior and exterior fencing, gates, and operators.
 - 5. Building signage.
- B. Owner will supply the following for installation by Contractor:
 - 1. Equipment indicated as "OFCl" (Owner Furnished, Contractor Installed) in equipment schedules on drawings.
 - a. Contractor shall coordinate with Owner's schedule to minimize disruption.

1.05 OWNER OCCUPANCY

- A. The existing building is unoccupied. Contractor will be given full access to the building and the site.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations to adjacent facilities.
- D. Schedule the Work to accommodate Owner occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

- A. Arrange use of site and premises to allow:
 - 1. Work by Owner.
- B. Provide access to and from site as required by law and by Owner:
 - 1. Do not obstruct roadways, sidewalks, or other public ways without permit.
- C. Existing building spaces may be used for construction material storage.
- D. Utility Outages and Shutdown:
 - 1. Coordinate any utility shut down with Owner.

2. Prevent accidental disruption of utility services to other facilities.

1.07 WORK SEQUENCE

- A. Contractor shall determine project sequence for most efficient and economical construction.
- B. Coordinate construction schedule and operations with Owner. Refer to the referenced Civil drawings for site constraints.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Change procedures.

1.02 RELATED REQUIREMENTS

- A. Section 005000 - Contracting Forms and Supplements: Forms to be used.
- B. Section 005200 - Agreement Form: Contract Sum, retainages, payment period, monetary values of unit prices.
- C. Section 007200 - General Conditions: Additional requirements for progress payments, final payment, changes in the Work.
- D. Section 012200 - Unit Prices: Monetary values of unit prices; Payment and modification procedures relating to unit prices.
- E. Section 017800 - Closeout Submittals: Project record documents.

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. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
- D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.
- E. Revise schedule to list approved Change Orders, with each Application For Payment.

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. Execute certification by signature of authorized officer.
- E. 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.
- F. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- G. Submit one electronic or three hard-copies of each Application for Payment.

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 fifteen days.

- D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
- E. Substantiation of Costs: Provide full information required for evaluation.
 - 1. Provide the following data:
 - a. Quantities and unit costs of materials and labor.
- F. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- G. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

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.

END OF SECTION

SECTION 012300

ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.

1.02 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.

1.03 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 – Silicone Roof Sealing System:
 - 1. Description: Preparation, priming, and installation of a silicone roof sealing system over the existing PEMB metal roof.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012500 SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 DEFINITIONS

- A. Substitutions: See General Conditions for definition.

1.03 REFERENCE STANDARDS

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.
 - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- 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. No specific form is required. Contractor's Substitution Request documentation must include the following:
 - a. Project Information:
 - b. Substitution Request Information:
 - 1) Indication of whether the substitution is for cause or convenience.
 - 2) Issue date.
 - 3) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
 - 4) Description of Substitution.
 - 5) Reason why the specified item cannot be provided.
 - 6) Differences between proposed substitution and specified item.
 - 7) 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.
 - 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 one organized electronic copy. See Section 013000, 3.01.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Owner will consider requests for substitutions only if submitted at least 10 days prior to the date for receipt of bids.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Architect will consider requests for substitutions only within 15 days after date of Agreement.
- B. 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.
- C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
 - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
 - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 - 3. Bear the costs engendered by proposed substitution of:
 - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
- D. 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.

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.

END OF SECTION

SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Coordination drawings.
- G. Submittals for review, information, and project closeout.
- H. Number of copies of submittals.
- I. Submittal procedures.

1.02 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 Information (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.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Architect will schedule a meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Civil Engineer.
 - 4. 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. Submission of initial Submittal schedule.
 - 6. Designation of personnel representing the parties to Contract and Architect.
 - 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 8. 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.

3.02 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

- B. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect.
 - 4. Civil Engineer.
 - 5. Contractor's superintendent.
 - 6. 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. Review of RFIs log and status of responses.
 - 7. Maintenance of progress schedule.
 - 8. Corrective measures to regain projected schedules.
 - 9. Planned progress during succeeding work period.
 - 10. Maintenance of quality and work standards.
 - 11. Effect of proposed changes on progress schedule and coordination.
 - 12. 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.

3.03 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. 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.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

3.04 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Retain first subparagraph below for projects requiring integrated coordination drawings showing information prepared by multiple contractors.
 - c. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - d. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - e. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

- f. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - g. Indicate required installation sequences.
 - h. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 - 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 - 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
 - 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 - 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 - 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 - 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column centerlines.
 - 8. Fire Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 - 9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Architect determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Architect will so inform the Contractor, who shall make changes as directed and resubmit.
 - 10. Retain subparagraph below if submittal of prints is adequate for review of coordination drawings and electronic file submittal for review or record is not required.
 - 11. Coordination Drawing Prints: Prepare coordination drawing prints in accordance with requirements of Division 01 Section "Submittal Procedures."

3.05 REQUESTS FOR INFORMATION (RFI)

- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.

2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- 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 software provided by the Electronic Document Submittal Service.
 4. Combine RFI and its attachments into a single electronic file.
- C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 1. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 016000 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 2. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 3. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
 - a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 1. Official Project name and number.
 2. Owner's, Architect's, and Contractor's names.
 3. Discrete and consecutive RFI number, and descriptive subject/title.
 4. Issue date, and requested reply date.
 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 2. Note dates of when each request is made, and when a response is received.
- G. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

3.06 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
 1. Submit at the same time as the preliminary schedule.

2. Coordinate with Contractor's construction schedule and schedule of values.
3. Format schedule to allow tracking of status of submittals throughout duration of construction.
4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.07 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.

3.08 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Sustainability design submittals and reports.
 3. Certificates.
 4. Test reports.
 5. Inspection reports.
 6. Manufacturer's instructions.
 7. Manufacturer's field reports.
 8. 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 stated.

3.12 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a separate transmittal for each item.
 - 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 form generated by Electronic Document Submittal Service software.
 - 4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 - 5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 6. 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.
 - 7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Upload submittals in electronic form to Electronic Document Submittal Service website.
 - 8. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - 9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 - 10. Provide space for Contractor and Architect review stamps.
 - 11. When revised for resubmission, identify all changes made since previous submission.
- B. Transmit each submittal with approved form.

END OF SECTION

SECTION 014000 QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Contractor's construction-related professional design services.
- F. Contractor's design-related professional design services.
- G. Control of installation.
- H. Mock-ups.
- I. Tolerances.
- J. Manufacturers' field services.
- K. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Section 014216 - Definitions.

1.03 REFERENCE STANDARDS

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants.
- B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing.
- G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components.
- H. IAS AC89 - Accreditation Criteria for Testing Laboratories.

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:
 - a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor's sole responsibilities for construction means, methods, techniques, sequences, and procedures.
 - b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.
- 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 CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

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

1.06 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.
 - 1. Submit a Request for Information to Architect if the criteria indicated are not sufficient to perform required design services.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
 - 1. Structural Design of Metal Framing: As described in Section 054000 - Cold-Formed Metal Framing.
 - 2. Structural Design of Metal Fabrications: As described in Section 055213 – Pipe and Tupe Railings.
 - 3. Design of Structural Components: Include development of shop drawings, and performing shop and site work, as described in Section 133419 - Metal Building Systems.
 - 4. Other requirements as listed in the Documents.

1.07 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
 - 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
 - a. Full name.
 - b. Professional licensure information.
 - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
- C. 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.
 - 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
 - 2. Include required product data and shop drawings.
 - 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
 - 4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect, to Owner, and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
 - 2. 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.

- E. 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.
- F. 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.
- G. 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.

1.08 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.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.
- 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.
- C. Contractor's Quality Control (CQC) Plan:
 - 1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
 - a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
 - b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
 - c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.
 - d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.

1.09 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 Agreement, 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.

1.10 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

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. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- G. Accepted mock-ups shall be a comparison standard for the remaining Work.
- H. 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 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Attend preconstruction meetings and progress meetings.
 - 8. Submit reports of all tests/inspections specified.
- C. 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.
- D. 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 a minimum of 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.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 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, and test and certify installation 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.

3.06 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 014216
DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.
- E. Provide: Furnish and install ready for its intended use.
- F. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 014533

STATEMENT OF SPECIAL INSPECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Following this page includes the "Statement of Special Inspections" for the Project:
 - 1. "Statement of Special Inspections: Parks, Recreation, and Tourism Office"

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION



ROANOKE COUNTY DEVELOPMENT SERVICES



Office of Building Safety

STATEMENT OF SPECIAL INSPECTIONS

DATE: 05/27/2025

PROJECT TITLE: PRT RENOVATION

PROJECT ADDRESS: 5305 HOLLINS ROAD, ROANOKE, VIRGINIA

BUILDING PERMIT #: _____

DESIGN PROFESSIONAL in RESPONSIBLE CHARGE: Michael J Fitzgerald, P.E.

This **Statement of Special Inspections** is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to this project as well as the name of the Special Inspection Coordinator and the identity of other approved agencies to be retained for conducting these inspections and tests. This **Statement of Special Inspections** encompasses the following disciplines:

☒ Structural

☒ Mechanical/Electrical/Plumbing

☒ Architectural

☐ Other: _____

The Special Inspection Coordinator shall keep records of all inspections and shall furnish inspection reports to the Building Official and the Registered Design Professional in Responsible Charge. Discovered discrepancies shall be brought to the **immediate** attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge.

A **Final Report of Special Inspections** documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the General Contractor (GC).

Interim Report Frequency:

or ☐ per attached schedule.

Prepared by:

Michael J Fitzgerald, P.E.

(type or print name)

Michael J Fitzgerald

Signature

05/24/2024

Date



Owner's Authorization:		Building Official's Acceptance:	
Signature	Date	Signature	Date



**ROANOKE COUNTY
DEVELOPMENT SERVICES
Office of Building Safety**



STATEMENT OF SPECIAL INSPECTIONS

Schedule of Inspection and Testing Agencies

This Statement of Special Inspections / Quality Assurance Plan includes the following building systems:

- | | |
|--|---|
| <input checked="" type="checkbox"/> Soils and Foundations
<input checked="" type="checkbox"/> Cast-in-Place Concrete
<input type="checkbox"/> Precast Concrete
<input type="checkbox"/> Masonry
<input checked="" type="checkbox"/> Structural Steel
<input type="checkbox"/> Cold-Formed Steel Framing | <input type="checkbox"/> Spray Applied Fire Resistant Material
<input type="checkbox"/> Wood Construction
<input type="checkbox"/> Exterior Insulation and Finish System
<input checked="" type="checkbox"/> Mechanical & Electrical Systems
<input type="checkbox"/> Architectural Systems
<input type="checkbox"/> Special Cases |
|--|---|

Special Inspection Agencies	Firm	Address, Telephone, e-mail
1. Special Inspection Coordinator		
2. Inspector		
3. Inspector		
4. Testing Agency		
5. Testing Agency		
6. Other		

Note: The inspectors and testing agencies shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official, prior to commencing work.



ROANOKE COUNTY DEVELOPMENT SERVICES

Office of Building Safety



STATEMENT OF SPECIAL INSPECTIONS

QUALITY ASSURANCE PLAN

IBC sections 1705 and 1706 require quality assurance plans to be submitted for certain seismic and/or wind requirements. The wind requirements are for higher wind regions and would not typically apply to projects located in Roanoke County. Seismic conditions in this locality often do result in the need for a quality assurance plan (see section 1705.1). Both plans are included below for your convenience.

Quality Assurance for Seismic Resistance

Seismic Design Category B

Quality Assurance Plan Required (Y/N) N

Description of seismic force resisting system and designated seismic systems:

STEEL FRAMES

Quality Assurance for Wind Requirements

Basic Wind Speed (3 second gust) 115

Wind Exposure Category B

Quality Assurance Plan Required (Y/N) N

Description of wind force resisting system and designated wind resisting components:

STEEL FRAMES

Statement of Responsibility

Each contractor responsible for the construction or fabrication of a system or component designated above must submit a Statement of Responsibility.



**ROANOKE COUNTY
DEVELOPMENT SERVICES
Office of Building Safety**



STATEMENT OF SPECIAL INSPECTIONS

Qualifications of Inspectors and Testing Technicians

The qualifications of all personnel performing Special Inspection and testing activities are subject to the approval of the Building Official. The credentials of all Inspectors and testing technicians shall be provided if requested.

Key for Minimum Qualifications of Inspection Agents:

When the Registered Design Professional in Responsible Charge, or Roanoke County Building Safety Office deems it appropriate that the individual performing a stipulated test or inspection have a specific certification or license as indicated below, such designation shall appear below the *Agency Number* on the Schedule.

Registered Design Professionals

PE/SE	Structural Engineer – a licensed SE or PE specializing in the design of building structures
PE/GE	Geotechnical Engineer – a licensed PE specializing in soil mechanics and foundations
PE/FPE	Fire Protection Engineer - a licensed PE specializing in design of fire protection systems *
PE/ME	Mechanical Engineer - a licensed PE specializing in design of mechanical systems *
EIT	Engineer-In-Training – a graduate engineer who has passed Fundamentals of Engineering exam

American Concrete Institute (ACI) Certification

ACI-CFTT	Concrete Field Testing Technician – Grade 1
ACI-CCI	Concrete Construction Inspector
ACI-LTT	Laboratory Testing Technician – Grade 1&2
ACI-STT	Strength Testing Technician

American Welding Society (AWS) Certification

AWS-CWI	Certified Welding Inspector
AWS/AISC-SSI	Certified Structural Steel Inspector

American Society of Non-Destructive Testing (ASNT) Certification

ASNT	Non-Destructive Testing Technician – Level II or III
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International Code Council (ICC) Certification

ICC-SMSI	Structural Masonry Special Inspector
ICC-SWSI	Structural Steel and Welding Special Inspector
ICC-SFSI	Spray-Applied Fireproofing Special Inspector
ICC-PCSI	Pre-stressed Concrete Special Inspector
ICC-RCSI	Reinforced Concrete Special Inspector

National Institute for Certification in Engineering Technologies (NICET)

NICET-CT	Concrete Technician – Levels I, II, III & IV
NICET-ST	Soils Technician - Levels I, II, III & IV
NICET-GET	Geotechnical Engineering Technician - Levels I, II, III & IV

Exterior Design Institute (EDI) Certification

EDI-EIFS	EIFS Third Party Inspector
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Note to A/E: Indicate in the "Y/N" column the special inspections required for this project.

2018 VUSBC SPECIAL INSPECTIONS

MATERIAL/ACTIVITY	TYPE OF TEST/INSPECTION	Y/N	EXTENT/ REFERENCE *	AGENCY # (QUALIF.)	SCOPE
GENERAL					
Pre-construction Conference	Meeting with parties listed to discuss Special Inspection procedures	Y	Roanoke County SI Guidelines	ALL agencies	Schedule by SI w/ Contractor prior to commencement of work
QUALITY ASSURANCE					
Seismic	Quality Assurance Plan		1705.3	PE/SE/ME	Seismic Classification (C,D,E,F)
Wind	Quality Assurance Plan		1705.4	PE/SE/ME	Wind Speed > 110 mph
FOUNDATIONS					
Soil	Compaction of Fill Materials	Y	Specs, 1704.7, C	PE/GE	Perform sieve tests and modified Proctor tests of each source of fill material, per ASTM standards Inspect placement, lift thickness and compaction of controlled fill Test density of lift of fill by nuclear meth. Verify extent and slope of fill placement
Soil	Bearing at bottom of footing excavations	Y			Inspect soils below footings for adequate bearing capacity and consistency with geotechnical report
Soil / Rock	Bottom of Caissons	N	Specs/Const., C 1810.7, P	PE/GE PE/GE	Inspect removal of unsuitable material and preparation of subgrade prior to placement of controlled fill
Piles	Driving records, tip & cutoff elevations	N	1704.8, 1808, 1809, C	PE/GE	Inspect and log pile driving operations Record pile driving resistance and verify compliance with driving criteria Inspect piles for damage from driving & plum. Verify pile size, length and accessories Inspect installation of drilled pier foundations Verify pier diameter, bell diameter, lengths, embedment into bedrock and suitability
Piles	Load Test	N	Specs, 1808.2.8.3.C	PE/GE	Monitor pile load test
Reinf. Bars	Size & placement in foundations	Y	ACI, Specs, C	ACI CCI ICC-RCSI	Inspect size, spacing, cover, positioning and grade of reinforcing steel. Verify that reinforcing bars are free from oil or other deleterious materials. Inspect bar laps and mechanical splices. Verify that bars are adequately tied and supported on chairs or bolsters
Piers	Size & placement of Reinf. Bars	Y	1704.9, C	ACI CCI ICC-RCSI	Inspect size, spacing, cover, positioning and grade of reinforcing steel. Verify that reinforcing bars are free from oil or other deleterious materials. Inspect bar laps and mechanical splices. Verify that bars are adequately tied and supported on chairs or bolsters

ATTACHMENT G: PROJECT PLANS AND SPECIFICATIONS

Project Manual

Approved: _____

Note to A/E: Indicate in the "Y/N" column the special inspections required for this project.

Other						
CONCRETE CONSTRUCTION						
Concrete	Ready-mix Plant quality control		Y		ACI CCI ICC-RCSI	Review concrete batch tickets and verify compliance with approved mix design. Verify that water added at the site does not exceed that allowed by the mix design, as permitted by ASTM C94.
Concrete	Mix design tests and certificates		Y		Specs, ACI, 1704.4 Specs, 1704.4.1, P	See Notes 1, 2, 3-Submit appropriate cert.
Reinf. Steel	Shop drawings of reinforcing steel		Y		PE/SER Specs, Note 1, 2,3	Verify compliance with specified design loads and specifications; verify on-site conditions match shop drawing details
Reinf. Steel	Placement of reinforcing steel		Y		ACI CCI ICC-RCSI 1704.4, C	Inspect size, spacing, cover, positioning and grade of reinforcing steel. Verify that reinforcing bars are free from oil or other deleterious materials. Inspect bar laps and mechanical splices. Verify that bars are adequately tied and supported on chairs or bolsters
Reinf. Steel	Welding		N		AWS-CWI 1704.4, P	Visually inspect all reinforcing steel welds. Verify weldability of reinforcing steel, inspect preheating of steel when required
Formwork	Design, placement & shoring		N		ACI CCI ICC-RCSI 1906.1, ACI 318 VUSBC 1704.4 P	Visually inspect placement, bracing, and general construction of formwork; review design of formwork
Formwork	Removal and reshoring		N		ACI CCI ICC-RCSI 1906.2, VUSBC 1704.4 P	Ensure implementation of shoring removal schedule is established and controlled
Concrete	Sampling and Testing		Y		ACI-CFTT ACI-STT 1704.4, 1905.6, C	Test concrete compressive strength (ASTM C31 & C39), slump (ASTM C143), air-content (ASTM C231 or C173) and temperature (ASTM C1064)
Concrete	Mix proportions & Mix on Delivery Tickets		Y		ACI CCI ICC-RCSI 1704.4, P	Verify use
Concrete	Placement procedures		Y		ACI CCI ICC-RCSI 1905.9, 1905.10, C	Inspect placement of concrete. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated
Concrete	Curing temperatures & techniques		N		ACI CCI ICC-RCSI 1905.11, P	Inspect curing, cold weather & hot weather protection procedures
Prestressed	Prestressing procedures & forces		N		ICC-PCSI 1704.4, C	Inspect placement, stressing, grouting and protection of post-tensioning tendons. Verify that tendons are correctly positioned, supported, tied, and wrapped. Record tendon elongations

Approved: _____

Note to A/E: Indicate in the "Y/N" column the special inspections required for this project.

Prestressed	Shop drawings of prestressed units Plant Certification/Quality control of Manufacturer		N	Specs	PE/SE	Verify compliance with specified design loads and specifications; verify on-site conditions match shop drawing details
Precast	<input type="checkbox"/> Fabricator Exempt		N	1704.2, P	ACI CCI ICC-RCSI	Review plant operations and quality control procedures
Precast	Shop drawings of precast		N	Specs	PE/SER	Verify compliance with specified design loads and specifications; verify on-site conditions match shop drawing details
Precast	Erection of precast		N	1704.4, P	PE/SE	Inspect erection of precast concrete including member configuration, connections, welding and grouting
Precast	Inspection of Connections		N	1704.4, P	PE/SE	Inspect size, positioning and embedment of connections. Inspect concrete placement and consolidation around anchors
Anchor Rods	Anchors cast in concrete		Y	1912, P	ACI CCI ICC-RCSI	Inspect size, positioning and embedment of anchor rods. Inspect concrete placement and consolidation around anchors
Other						
MASONRY CONSTRUCTION Required Inspection Level: 1 2 (IBC section 1704.5.1, 1704.5.2 and 1704.5.3)						
Material Certification	Certificates, Tests & technical data		N	1704.5, 1708.1 ACI 530.1	PE/SE	For clay and/or concrete masonry-submittal and field review meeting all specifications
Reinf. Steel	Shop Drawings		N	Specs, 1704.5	PE/SER	Fire Resistant rated assemblies included Verify compliance with specified design loads and specifications; verify on-site conditions match shop drawing details
Reinf. Steel	Condition, Size, Location, Spacing of Reinf Steel		N	1704.5.ACI 530.1,C	ICC-SMSI AWS-CWI	Inspect size, location, condition, spacing and lapping or reinforcing steel Inspect welding of reinforcing steel
Mixing of Mortar and Grout	Proportioning & Mixing		N	1704.5.ACI 530.1,C	ICC-SMSI	Inspect proportioning, mixing, and retempering of mortar and grout
Installation of Masonry	Application & Installation		N	1704.5.ACI 530.1,P	ICC-SMSI	Inspect size, layout, bonding and placement of masonry units
Mortar Joints	Application & Installation		N	1704.5.ACI 530.1,P	ICC-SMSI	Inspect construction of mortar joints including tooling and filling of head joints
Prestressed Masonry	Application & Installation		N	1704.5.ACI 530.1,P	ICC-SMSI	Inspect placement, anchorage and stressing of prestressing bars
Grouting Operations	Application & Installation		N	1704.5.ACI 530.1,C	ICC-SMSI	Inspect placement and consolidation of grout. Inspect masonry clean-outs for high-lift grouting
Weather Protection	Cold, Hot & Rainy Weather protection investigation		N	1704.5.ACI 530.1,P	ICC-SMSI	Inspect curing, cold weather & hot weather protection procedures. Verify that wall cavities are protected against precipitation
Evaluation of Masonry Strength	Testing/review of strength		N	1704.5.ACI 530.1,P	ICC-SMSI	Test compressive strength of mortar (ASTM C780) and grout specimen samples (ASTM C1019). Test compressive strength per unit strength method (ASTM C140)

Approved: _____

Note to A/E: Indicate in the "Y/N" column the special inspections required for this project.

Anchors & Ties	Inspection of anchorages		N	1704.5.ACI 530.1, P	ICC-SMSI	Inspect size, location, spacing and embedment of dowels, anchors, and ties
Seismic	Reinforcing (Seismic Design Cat. "C")		N	1704.8.1, P	PE/SE	
Other						
STEEL CONSTRUCTION						
Steel Member Fabricator	Plant Certification/Quality control of Manufacturer		Y		AWS/AISC-SSI ICC-SWSI	Review shop fabrication and quality control procedures
	<input type="checkbox"/> Fabricator Exempt			1704.2, P		
Material Certification	Mfr's Certificate of Compliance Structural Steel		Y	1704.3, P	AWS/AISC-SSI ICC-SWSI	Review certified mill reports and identification markings for wide-flange shapes
	Mfr's Certificate of Compliance Bolts, nuts, washers & connectors		Y	1704.3, P	AWS/AISC-SSI ICC-SWSI	Review certified mill reports and identification markings for high-strength bolts, nuts and welding electrodes
Open Web Steel Joists	Inspection of joists installation		Y	1704.3, P	AWS/AISC-SSI ICC-SWSI	Inspect installation, field welding and bridging of joists
Steel Framing Drawings	Shop drawings review		Y	Specs	PE/SER	Verify compliance with specified design loads and specifications; verify on-site conditions match shop drawing details
Erection-Bolting	Installation of High-strength Bolts		N	1704.3.3, AISC LRFD, P	AWS/AISC-SSI ICC-SWSI	Inspect installation and tightening of high-strength bolts. Verify that splines have separated from tension control bolts. Verify proper tightening sequence.
	Installation of Slip-critical Bolts		N	1704.3.3, AISC LRFD, C	AWS/AISC-SSI ICC-SWSI	Inspect installation and tightening of high-strength bolts. Verify that splines have separated from tension control bolts. Verify proper tightening sequence. Continuous inspection of bolts in slip critical connec.
Erection-Welding	Welding		Y	1704.3.1, 1707.2 AWS, C	AWS-CWI ASNT	Visually inspect all welds. Inspect pre-heat, post-heat and surface preparation between passes. Verify size and length of fillet weld Ultrasonic testing of all full-penetration welds
Erection-Shear Connections	Steel Framing and Connections		Y	1704.3.2, P	AWS/AISC-SSI ICC-SWSI	Inspect size, number, positioning and welding of shear connectors. Inspect studs for full 360 degree flash. Ring test all shear connectors with a 3lb hammer. Bend test all questionable studs to 15 degrees
Structural Details	Inspection of structural details		Y	1704.3.2, P	PE/SE	Inspect steel frame for compliance with structural drawings, including bracing, member configuration and connection details

Approved: _____

Note to A/E: Indicate in the "Y/N" column the special inspections required for this project.

Metal Decking	Inspection of metal deck connections	Y	1704.3, P	AWS-CWI	Inspect welding and side lap fastening of metal roof and floor deck
Other					
COLD-FORMED STEEL FRAMING					
Member Sizes		N	1707.4, P		
Material Thickness		N	1707.4, P		
Material Properties		N	1707.4, P		
Mechanical Connections	Fastening per code and drawings	N	1707.4, P		
Welding		N	1707.4, P		
Framing Details		N	1707.4, P		
Trusses	Shop drawings	N	1707.4, P	PE/SER	Verify compliance with specified design loads and specifications; verify on-site conditions match shop drawing details
Permanent Truss Bracing	Truss placement, fastening & anchorage	N	1707.4, P		
Other			1707.4, P		
WOOD CONSTRUCTION					
Wood Pre-Fabrication	Plant Certification/Quality control of Manufacturer <input type="checkbox"/> Fabricator Exempt	N	1704.2, P		Inspect shop fabrication and quality control procedures for wood truss plant
Material Grading	Grade stamp	N	Specs		
Connections	Fastening per code and drawings	N	Specs, 1704.6, P		
Framing and Details		N			
Diaphragms and Shearwalls		N	1704.6.1, P		Inspect size, configuration, blocking, and fastening of shearwalls and diaphragms. Verify panel grade and thickness
Trusses	Shop drawings	N	Specs	PE/SER	Verify compliance with specified design loads and specifications; verify on-site conditions match shop drawing details
Trusses	Truss placement, fastening & anchorage	N	Specs, 1704.6, P		
Laminates	Shop drawings	N	Specs	PE/SER	Verify compliance with specified design loads and specifications; verify on-site conditions match shop drawing details
Laminates	Identification per shop drawings	N	Specs		

Note to A/E: Indicate in the "Y/N" column the special inspections required for this project.

Plywood	Grade stamp & thickness	N	Specs, 1704.6.1		
Other					
SPRAY-APPLIED FIRE RESISTANT MATERIAL (SFRM)					
Material Specifications	Manufacturer's data	N	Specs	PE/SE/FPE	
Laboratory Tested Fire Resistance Design		N	1704.10.1	ICC-SFSI	Review Third-party fire resistive design assembly (eg. UL, FM, etc.) for each rated beam, column, or assembly
Schedule of Thickness		N	1704.10.2, P	ICC-SFSI	Review approved thickness schedule
Surface Preparation	Surface Conditions	N	1704.10.3, P	ICC-SFSI	Inspect surface preparation of steel prior to application of SFRM
Application		N	1704.10.4, P	ICC-SFSI	Inspect application of SFRM
Curing and Ambient Condition		N	1704.10.5, P	ICC-SFSI	Verify ambient temperature and ventilation is suitable for application and curing of SFRM
Thickness		N			Test thickness of SFRM (ASTM E605). Perform a set of thickness measurements for every 1,000 SF of floor and roof assemblies and on not less than 25% of rated beams and columns
Density		N	1704.10.3.Spec, P	ICC-SFSI	
Bond Strength		N	1704.10.4.Spec, P	ICC-SFSI	Test density of SFRM material (ASTM E605)
Other		N	1704.10.5.Spec, P	ICC-SFSI	Test the cohesive/adhesive bond strength of SFRM (ASTM E736). Perform not less than one test for each 10,000 SF.
Other			Specs, P		
MASTIC and INTUMESCENT FIRE-RESISTIVE COATINGS					
Application	Inspect mastic and intumescent fire-resistant coatings applied to structural elements and decks, in accordance with AWCI 12-B.	N	1704.11, AWCI 12-B, P	ICC-SFSI	Verify thickness and application of coatings prescribed in fire-resistant design.
EXTERIOR INSULATION and FINISH SYSTEMS (EIFS)					
Material Submittal		N	Specs	EDI-EIFS	
Condition of Substrate		N	Specs	EDI-EIFS	
Application of Foam Plastic Board		N	Specs, 1704.12, P	EDI-EIFS	
Application of Coatings		N	Specs, 1704.12, P	EDI-EIFS	
Application of Mesh		N	Specs, 1704.12, P	EDI-EIFS	
Ambient Condition and Curing		N	Specs, 1704.12, P	EDI-EIFS	

Note to A/E: Indicate in the "Y/N" column the special inspections required for this project.

Flashing and Joint Details		N	Specs, 1704.12, P	EDI-EIFS	
Sealants/Caulks		N	Specs, 1704.12, P	EDI-EIFS	
Other					
SMOKE CONTROL					
Ducts	Device location and air duct leakage	N	1704.14, P	PE/FPE/ME	
System	Pressure difference, flow measurements & detection testing	N	1704.14, P	PE/FPE/ME	
Controls	Activation sequence	N	1704.14, P	PE/FPE/ME	
Other					
ARCHITECTURAL/MECHANICAL/ELECTRICAL SYSTEMS					
Components	Storage Racks		1707.6, ASCE 7, P		
Wall Panels & Veneers	Architectural Exterior Cladding		1707.7, ASCE 7, P		
Suspended Ceilings	Periodic Anchorage Inspection		1707.6, ASCE 7, P		
Access Floors	Periodic Anchorage Inspection		1707.6, ASCE 7, P		
Partitions	Periodic Anchorage Inspection		1707.7, ASCE 7, P		
Mechanical Systems	Mechanical, HVAC & Piping		1707.8, 1708.5, P		
Electrical Systems	Emergency & Standby Power Sys.		1707.8, 1708.5, P		
Fire Wall Assemblies	Manufacturer's Data		Specs		
Fire Wall Assemblies	Placement of Materials		Specs		
Other					
EARTH RETAINING STRUCTURES >10 FT. UNBALANCED FILL					
Footings, Foundation	Inspect placement of foundation system	N	Specs, County Pol.	PE/SE/GE	
Backfill Information	Confirm type of soil and height	N	Specs, County Pol.	PE/SE/GE	
Guard Rail	Load Test	N	Specs, County Pol.	PE/SE/GE	
Wall Geometry	Verify dimensions of wall per appr. Plans	N	Specs, County Pol.	PE/SE/GE	
Compaction Testing	Compaction of Fill Materials	N	Specs, County Pol.	PE/SE/GE	
Layout Information		N	Specs, County Pol.	PE/SE/GE	
Other					
SPECIAL CASES					
Alternative Materials & Sys.	As requested by Building Official, review and installation	N	1704.13		
System Commissioning	Commissioning Systems for LEED certified projects, etc.	N			
Other					

Note:

Approved:_____

Note to A/E: Indicate in the "Y/N" column the special inspections required for this project.

1. Fabricator, supplier, ready-mixed plant or other production plant shall provide certificates from an approved independent inspection, testing or quality assurance agency attesting that the plant meets at least one of the following criteria:
 - a. The plant is a certified production plant meeting the quality assurance standards of a recognized national standards organization for that product.
 - b. The plant maintains an agreement with an independent inspection or quality assurance agency to conduct periodic in-plant quality assurance inspections, where frequency is no less than 6 months.
 - c. The plant has an in-shop quality assurance inspection program by an independent testing or quality assurance agency for the work/product to be provided on this project.
2. A/E shall review fabricator/supplier/producer certificates and shop drawings for conformance with appropriate standards of practice and quality assurance.
3. Contractor/supplier shall submit manufacturer's certificates of compliance and shop drawings for the materials/products.
4. Special inspection personnel/firm(s) selected to perform smoke control commissioning must have experience in fire protection engineering, mechanical engineering, and certification as an air balancer.
5. References to Agency/personnel qualifications that are already listed are considered to be a minimum by the Building Official, unless otherwise specifically approved. A Registered Design Professional (RDP), i.e., Arch./PE is considered to meet any of the minimum certification requirements listed above.
6. Unless otherwise noted, the reference numbers listed above refer to the 2006 VUSBC & 2006 IBC.
7. Notations to Periodic (P) or Continuous (C) inspections indicate frequency of certain inspections.

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- I. Field offices.

1.02 TEMPORARY UTILITIES

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. Existing facilities may be used.
- C. New permanent facilities may be used.

1.03 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Telephone: One line, minimum.
 - 3. Internet Connections: Minimum of one.

1.04 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.05 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. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 FENCING

- A. Construction: Contractor's option.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 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:

1.09 SECURITY

- 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.

1.10 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- F. Coordinate Contractor's required parking with Owner's continued use of the Property where applicable.

1.11 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.

1.12 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.

1.13 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Office may be located in the existing building, if practical.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Final Application for Payment inspection.
- B. Remove underground installations to a minimum depth of 2 feet. 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.
- E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 016000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations.
- F. Procedures for Owner-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Lists of products to be removed from existing building.
- B. Section 011000 - Summary: Identification of Owner-supplied products.
- C. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- D. Section 015000 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 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 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
- C. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.
 - 1. See drawings for list of items required to be salvaged for reuse and relocation.

2.02 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:
 - 1. Containing lead, cadmium, or asbestos.

2.03 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.

204 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

301 SUBSTITUTION LIMITATIONS

- A. See Section 012500 - Substitution Procedures.

302 OWNER-SUPPLIED PRODUCTS

- A. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
 - 1. Review Owner reviewed shop drawings, product data, and samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
 - 3. Handle, store, install and finish products.
 - 4. Repair or replace items damaged after receipt.

303 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.

304 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 015000.
- 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

SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 013000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 014000 - Quality Requirements: Testing and inspection procedures.
- D. Section 015000 - Temporary Facilities and Controls: Temporary exterior enclosures.
- E. Section 015000 - Temporary Facilities and Controls: Temporary interior partitions.

1.03 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. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.
- D. 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.
- E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 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.

1.05 PROJECT CONDITIONS

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
 - 2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

1.06 COORDINATION

- A. See Section 011000 for occupancy-related requirements.
- B. 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.
- C. Notify affected utility companies and comply with their requirements.
- D. 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.
- E. 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.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of work of separate sections.
- H. 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

201 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

301 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 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect 7 days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. 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 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.

3.05 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.

3.06 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. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. 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.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, 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. See Section 011000 for other limitations on outages and required notifications.
 - c. 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.

- F. 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 newwork.
 - 3. Repair adjacent construction and finishes damaged during removal work.
- G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
 - 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
 - 2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
 - 3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
- H. 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.
- I. 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.
- J. Clean existing systems and equipment.
- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Do not begin new construction in alterations areas before demolition is complete.
- M. Comply with all other applicable requirements of this section.

3.07 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 the Construction Documents, 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.

3.08 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.

3.09 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.

3.10 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. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of final inspection.
- 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.
- E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.12 ADJUSTING

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

3.13 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Use cleaning materials that are nonhazardous.
- C. 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.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and _____.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect, Civil Engineer, and Owner.
- B. Notify Architect and Civil Engineer when work is considered ready for Architect's Substantial Completion inspection.
- C. 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.
- D. 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.
- E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

- F. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- G. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

END OF SECTION

SECTION 017800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 007200 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.

1.03 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.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- 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 and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Field changes of dimension and detail.
 - 4. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. 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.
- D. 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. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
 - 2. Information for re-ordering custom manufactured products.
 - 3. See additional requirements in Division 09 painting sections.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. 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. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. 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.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

- D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Provide servicing and lubrication schedule, and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.
- H. Include sequence of operation by controls manufacturer.
- I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Additional Requirements: As specified in individual product specification sections.

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 three D side ring binders with durable plastic covers; 2 inch 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.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Operation and maintenance data.
 - c. Field quality control data.
 - d. Photocopies of warranties and bonds.

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.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 022600 – HAZARDOUS MATERIALS ASSESSMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
- B. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.2 FIELD CONDITIONS

- A. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

1.3 WARRANTY

- A. Notify warrantor on completion of remediation and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- B. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.

END OF SECTION 022600

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.

1.2 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 FIELD CONDITIONS

- A. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- B. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- C. Storage or sale of removed items or materials on-site is not permitted.
- D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
- E. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.4 WARRANTY

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 2. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 4. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
 - 5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 6. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area.
 - 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse.
 - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.

3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 CLEANING

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 030130 - MAINTENANCE OF CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Removal of deteriorated concrete and subsequent patching.
 - 2. Floor joint repair.
 - 3. Epoxy crack injection.
 - 4. Corrosion-inhibiting treatment.
 - 5. Polymer sealers.
- 1.2 ACTION SUBMITTALS
 - A. Product Data: For each type of product.
- 1.3 INFORMATIONAL SUBMITTALS
 - A. Material certificates.
 - B. Product test reports.
 - C. Field quality-control reports.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
 - A. Source Limitations: For repair products, obtain each color, grade, finish, type, and variety of product from single source and from single manufacturer with resources to provide products of consistent quality in appearance and physical properties.
- 2.2 PATCHING MORTAR
 - A. Patching Mortar Requirements:
 - 1. Only use patching mortars that are recommended by manufacturer for each applicable horizontal, vertical, or overhead use orientation.
 - B. Cementitious Patching Mortar: Packaged, dry mix for repair of concrete.
 - C. Polymer-Modified, Cementitious Patching Mortar: Packaged, dry mix for repair of concrete and that contains a latex additive as either a dry powder or a separate liquid that is added during mixing.
- 2.3 JOINT FILLER
 - A. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of at least 80 according to ASTM D2240.
- 2.4 CORROSION-INHIBITING MATERIALS
 - A. Corrosion-Inhibiting Treatment: Waterborne solution of alkaline corrosion-inhibiting chemicals for concrete-surface application that penetrates concrete by diffusion and forms a protective film on steel reinforcement.
- 2.5 MISCELLANEOUS MATERIALS
 - A. Portland Cement: ASTM C150/C150M, Type I, II, or III unless otherwise indicated.
 - B. Water: Potable.
- 2.6 MIXES
 - A. General: Mix products, in clean containers, according to manufacturer's written instructions.
 - B. Dry-Pack Mortar: Mix required type(s) of patching-mortar dry ingredients with just enough liquid to form damp cohesive mixture that can be squeezed by hand into a ball but is not plastic.

PART 3 - EXECUTION

3.1 CONCRETE MAINTENANCE

- A. Have concrete-maintenance work performed only by qualified concrete-maintenance specialist.
- B. Comply with manufacturers' written instructions for surface preparation and product application.

3.2 EXAMINATION

- A. Notify Architect seven days in advance of dates when areas of deteriorated or delaminated concrete and deteriorated reinforcing bars will be located.
- B. Perform surveys as the Work progresses to detect hazards resulting from concrete-maintenance work.

3.3 PREPARATION

- A. Ensure that supervisory personnel are on-site and on duty when concrete maintenance work begins and during its progress.
- B. Protect persons, motor vehicles, surrounding surfaces of building being repaired, building site, plants, and surrounding buildings from harm resulting from concrete maintenance work.
 - 1. Comply with each product manufacturer's written instructions for protections and precautions.
 - 2. Contain dust and debris generated by concrete maintenance work and prevent it from reaching the public or adjacent surfaces.
 - 3. Protect floors and other surfaces along haul routes from damage, wear, and staining.
 - 4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
- C. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is in working order.
 - 1. Prevent solids such as aggregate or mortar residue from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from concrete maintenance work.
 - 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.
- D. Preparation for Concrete Removal: Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed in the course of repair.
 - 1. Verify that affected utilities have been disconnected and capped.

3.4 REMOVAL OF CONCRETE

- A. Do not overload structural elements with debris.
- B. Saw-cut perimeter of areas indicated for removal to a depth of at least 1/2 inch. Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.
- C. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement.
- D. Remove additional concrete if necessary to provide a depth of removal of at least 1/2 inch over entire removal area.
- E. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar and to provide at least 3/4-inch clearance around bar.
- F. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound and disbonded concrete is completely removed.
- G. Provide surfaces with a fractured profile of at least 1/8 inch that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level unless otherwise directed.
- H. Thoroughly clean removal areas of loose concrete, dust, and debris.

3.5 INSTALLATION OF PATCHING MORTAR

- A. Place patching mortar as specified in this article unless otherwise recommended in writing by manufacturer.
 - 1. Provide forms where necessary to confine patch to required shape.
 - 2. Wet substrate and forms thoroughly and then remove standing water.
- B. Pretreatment: Apply specified [bonding agent] [slurry coat] [bonding agent and slurry coat] <Insert requirement>.
- C. General Placement: Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.

- D. Vertical Patching: Place material in lifts of not more than thickness recommended by manufacturer. Do not feather edge.
- E. Consolidation: After each lift is placed, consolidate material and screed surface.
- F. Multiple Lifts: Where multiple lifts are used, score surface of lifts to provide a rough surface for placing subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.
- G. Curing: Wet-cure cementitious patching materials, including polymer-modified cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.

3.6 INSTALLATION OF DRY-PACK-MORTAR

- A. Use dry-pack mortar for deep cavities. Place as specified in this article unless otherwise recommended in writing by manufacturer.
 - 1. Provide forms where necessary to confine patch to required shape.
 - 2. Wet substrate and forms thoroughly and then remove standing water.
- B. Place dry-pack mortar into cavity by hand, and compact tightly into place. Do not place more material at a time than can be properly compacted. Continue placing and compacting until patch is approximately level with surrounding surface.
- C. After cavity is filled and patch is compacted, trowel surface to match profile and finish of surrounding concrete.
- D. Wet-cure patch for not less than seven days by water-fog spray or water-saturated absorptive cover.

3.7 FLOOR-JOINT REPAIR

- A. Cut out deteriorated concrete and reconstruct sides of joint with patching mortar as indicated on Drawings. Install joint filler in nonmoving floor joints where indicated and as specified in this article.
- B. Depth: Install joint filler to a depth of at least 3/4 inch. Use fine silica sand no more than 1/4 inch deep to close base of joint. Do not use sealant backer rods or compressible fillers below joint filler.
- C. Top Surface: Install joint filler so that when cured, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.

3.8 EPOXY CRACK INJECTION

- A. Clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
- B. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond.
- C. Place injection ports as recommended by epoxy manufacturer, spacing no farther apart than thickness of member being injected. Seal injection ports in place with capping adhesive.
- D. Seal cracks at exposed surfaces with a ribbon of capping adhesive at least 1/4 inch thick by 1 inch wider than crack.
- E. Inject epoxy adhesive, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports when they extrude epoxy. Cap injected ports and inject through adjacent ports until crack is filled.
- F. After epoxy adhesive has set, remove injection ports and grind surfaces smooth.

END OF SECTION 030130

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Form-facing material for cast-in-place concrete.
 - 2. Shoring, bracing, and anchoring.

1.2 ACTION SUBMITTALS

- A. Product Data: For each of the following:
 - 1. Exposed surface form-facing material.
 - 2. Concealed surface form-facing material.
 - 3. Form ties.
 - 4. Waterstops.
 - 5. Form-release agent.
- B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.
 - 1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
 - 2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.

- F. Do not use rust-stained, steel, form-facing material.
 - G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips.
 - 2. Use strike-off templates or compacting-type screeds.
 - H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
 - I. Chamfer exterior corners and edges of permanently exposed concrete.
 - J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
 - K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - L. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired.
 - 3. Place joints perpendicular to main reinforcement.
 - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 - 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
 - N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
 - O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
 - P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- 3.2 INSTALLATION OF EMBEDDED ITEMS
- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 3. Clean embedded items immediately prior to concrete placement.
- 3.3 FIELD QUALITY CONTROL
- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel reinforcement bars.
 - 2. Welded-wire reinforcement.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of steel reinforcement.
- B. Shop Drawings: Comply with ACI SP-066:
 - 1. Include placing drawings that detail fabrication, bending, and placement.
 - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
 - 1. Reinforcement to Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."
- C. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Steel Reinforcement:
 - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, **Grade 60**, deformed.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
- B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.

2.3 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
 - 2. Stagger splices in accordance with ACI 318.
- G. Install welded-wire reinforcement in longest practicable lengths.
 - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.
 - 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
 - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 - 4. Lace overlaps with wire.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

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

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
 - 2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

- A. Product Data: For each of the following.
 - 1. Portland cement.
 - 2. Fly ash.
 - 3. Slag cement.
 - 4. Blended hydraulic cement.
 - 5. Aggregates.
 - 6. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
 - 7. Vapor retarders.
 - 8. Liquid floor treatments.
 - 9. Curing materials.
 - 10. Joint fillers.
- B. Design Mixtures: For each concrete mixture, include the following:
 - 1. Mixture identification.
 - 2. Minimum 28-day compressive strength.
 - 3. Durability exposure class.
 - 4. Maximum w/cm.
 - 5. Calculated equilibrium unit weight, for lightweight concrete.
 - 6. Slump limit.
 - 7. Air content.
 - 8. Nominal maximum aggregate size.
 - 9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
 - 10. Intended placement method.
 - 11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Shop Drawings:
 - 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.
- D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
 - 1. Concrete Class designation.
 - 2. Location within Project.
 - 3. Exposure Class designation.
 - 4. Formed Surface Finish designation and final finish.

5. Final finish for floors.
 6. Curing process.
 7. Floor treatment if any.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Material Certificates: For each of the following, signed by manufacturers:
 1. Cementitious materials.
 - B. Material Test Reports: For the following, from a qualified testing agency:
 1. Portland cement.
 2. Fly ash.
 3. Slag cement.
 4. Blended hydraulic cement.
 5. Aggregates.
 6. Admixtures:
 - C. Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
 - D. Preconstruction Test Reports: For each mix design.
- 1.5 PRECONSTRUCTION TESTING
- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
 1. Include the following information in each test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Seven-day compressive strength.
 - e. 28-day compressive strength.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Comply with ASTM C94/C94M and ACI 301.
- 1.7 FIELD CONDITIONS
- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1.
 - B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.

PART 2 - PRODUCTS

- 2.1 CONCRETE, GENERAL
- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.
- 2.2 CONCRETE MATERIALS
- A. Cementitious Materials:
 1. Portland Cement: ASTM C150/C150M, Type I.
 - B. Normal-Weight Aggregates: ASTM C33/C33M, coarse aggregate or better, graded. Provide aggregates from a single source.
 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 - C. Air-Entraining Admixture: ASTM C260/C260M.
 - D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 2. Retarding Admixture: ASTM C494/C494M, Type B.
 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
 4. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
 - E. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
 - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash or Other Pozzolans: 25 percent by mass.
 - 2. Slag Cement: 50 percent by mass.
 - 3. Total of Fly Ash or Other Pozzolans, Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass.
 - 4. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.5 CONCRETE MIXTURES

- A. Normal-weight concrete.
 - 1. All exterior concrete slabs exposed to traffic shall be 4000 psi. All concrete slabs, on-grade or on suspended metal deck, shall be 3500 psi. Footings for walls and columns, and all other concrete, shall be 3000 psi.
 - 2. All concrete exposed to freezing and thawing shall have an entrained air content of 6% ($\pm 1.5\%$).
 - 3. Refer to Table 19.3.2.1 "Requirements for Concrete by Exposure Class" and referenced exposure class definitions for maximum water / cementitious materials (w/c) ratio, minimum design strength, entrained air contents, and other constituent restrictions for this project.
 - 4.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.2 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
 - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 - 2. Face laps away from exposed direction of concrete pour.
 - 3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
 - 4. Lap joints 6 inches and seal with manufacturer's recommended tape.
 - 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
 - 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
 - 7. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.3 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 - 1. Install so strength and appearance of concrete are not impaired.
 - 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 3. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 - 2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
 - 1. Install dowel bars and support assemblies at joints where indicated on Drawings.
 - 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.4 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
 - 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 - 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.

3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
 - E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Do not place concrete floors and slabs in a checkerboard sequence.
 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 3. Maintain reinforcement in position on chairs during concrete placement.
 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 5. Level concrete, cut high areas, and fill low areas.
 6. Slope surfaces uniformly to drains where required.
 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 8. Do not further disturb slab surfaces before starting finishing operations.
- 3.5 FINISHING FORMED SURFACES
- A. As-Cast Surface Finishes:
 1. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - b. Remove projections larger than 1/4 inch.
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class B.
 - B. Related Unformed Surfaces:
 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
 2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.
- 3.6 FINISHING FLOORS AND SLABS
- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
 - B. Scratch Finish:
 1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
 2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
 - C. Float Finish:
 1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
 2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
 - D. Trowel Finish:
 1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
 2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 4. Do not add water to concrete surface.
 5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.

6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
 1. Coordinate required final finish with Architect before application.
 2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
 - F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
 2. Coordinate required final finish with Architect before application.
- 3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS
- A. Filling In:
1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
 2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
 3. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- 3.8 CONCRETE CURING
- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
 3. If forms remain during curing period, moist cure after loosening forms.
 4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheetting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
1. Begin curing immediately after finishing concrete.
 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

- b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- b. Floors to Receive Polished Finish: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.

3.9 TOLERANCES

- A. Conform to ACI 117.

3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- C. Inspections:
 - 1. Headed bolts and studs.
 - 2. Verification of use of required design mixture.
 - 3. Concrete placement, including conveying and depositing.
 - 4. Curing procedures and maintenance of curing temperature.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 - 3. Slump Flow: ASTM C1611/C1611M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 - 4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 5. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 - 6. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of [two] [three] [four] 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
 - 7. Compressive-Strength Tests: ASTM C39/C39M.

- a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 - b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
 - c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:
 - a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.11 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 033543 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Polished concrete finishing.

1.2 QUALITY ASSURANCE

- A. Field Sample Panels: After approval of samples, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches minimum, to demonstrate the expected range of finish, color, and appearance variations.
 - 1. Locate panels as indicated or, if not indicated, as directed by Owner.
 - 2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Demolish and remove field sample panels when directed.

PART 2 - PRODUCTS

2.1 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

PART 3 - EXECUTION

3.1 POLISHING

- A. Polish: Level 3: High sheen, 800 grit.
- B. Apply polished concrete finish system to cured and prepared slabs.
 - 1. Machine grind floor surfaces to receive polished finishes level and smooth.
 - 2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
 - 3. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
 - 4. Control and dispose of waste products produced by grinding and polishing operations.
 - 5. Neutralize and clean polished floor surfaces.

END OF SECTION 033543

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior non-load-bearing wall framing.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Cold-formed steel framing materials.
 - 2. Interior non-load-bearing wall framing.

1.3 QUALITY ASSURANCE

- A. Product Tests: Mill certificates or data from a qualified independent testing agency.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and AISI S240.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

- A. Framing Members, General: Comply with AISI S240 for conditions indicated.

2.3 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 16 gage or heavier.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.
- C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Base and top tracks shall be fastened to supporting slab or structure as noted. For non-load bearing walls provide 0.157"-diameter power driven fasteners (pdfs) at a maximum spacing of 16" o.c. Use Hilti X-U (or equivalent) fasteners of appropriate length to penetrate full thickness of supporting steel member or to provide a minimum 1-1/4" embedment into concrete. For interior load bearing walls, fasten base track to supporting concrete with Hilti KWIK HUS (or equivalent) screw anchors at 24" o.c. maximum spacing (16" o.c. at exterior walls).
- B. Powder actuated fasteners shall not be located less than 3" from a free edge of concrete nor spaced closer than 4" on center when shot into concrete bases.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
- D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- E. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- F. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.2 INSTALLATION OF INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Connect vertical deflection clips to studs and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.3 REPAIRS

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 054000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel railings.

1.2 ACTION SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- B. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.3 STEEL RAILINGS

- A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.
- B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- C. Plates, Shapes, and Bars: ASTM A36/A36M.

2.4 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION

- A. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.
- B. Form work true to line and level with accurate angles and surfaces.
- C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove flux immediately.
- D. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- E. Form changes in direction as follows:
 1. By bending or by inserting prefabricated elbow fittings.
- F. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- G. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- I. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
 1. Fit exposed connections together to form tight, hairline joints.
 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 ANCHORING POSTS

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

3.3 CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055213

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Extruded polystyrene foam-plastic board insulation.
 - 2. Glass-fiber blanket insulation.
- 1.2 ACTION SUBMITTALS
 - A. Product Data: For the following:
 - 1. Extruded polystyrene foam-plastic board insulation.
 - 2. Glass-fiber blanket insulation.

PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
 - A. Thermal-Resistance Value (R-Value): Refer to the Code Summary in the Drawings with regards to Energy Conservation in Alterations.
- 2.2 POLYSTYRENE FOAM-PLASTIC BOARD INSULATION
 - A. Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
- 2.3 GLASS-FIBER BLANKET INSULATION
 - A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 - B. Glass-Fiber Blanket Insulation, Kraft Faced: ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).
- 2.4 ACCESSORIES
 - A. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.
 - B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
 - A. Comply with insulation manufacturer's written instructions applicable to products and applications.
 - B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
 - C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
 - D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
 - E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.
- 3.2 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION
 - A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed toward interior of construction.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

END OF SECTION 072100

SECTION 072413 - POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

1.1 QUALITY ASSURANCE

- A. Mockups for each form of construction and finish.

1.2 MATERIALS

- A. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite.
- B. Insulation adhesive.
- C. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M.
 - 1. Foam buildouts.
- D. Reinforcing Mesh: Alkali-resistant, glass-fiber mesh.
- E. Base coat.
- F. Water-resistant base coat.
- G. Finish Coat: Standard acrylic-based coating.
- H. Trim accessories.

1.3 INSTALLATION

- A. Insulation: Adhered to substrate in compliance with ASTM C1397.
- B. Expansion joints.
- C. Water-Resistant Base Coat: Applied full-thickness coverage to exposed insulation and to exposed surfaces of sloped shapes, window sills, foam buildouts.
- D. Base Coat: Applied full-thickness coverage to exposed insulation.
- E. Reinforcing mesh.
- F. Finish Coat: Applied over primed base coat.

END OF SECTION 072413

SECTION 075600 - SILICONE ROOF SEALING SYSTEM OVER METAL SUBSTRATE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This specification is intended to outline the requirements for application of a silicone based roof coating system, in conjunction with the appropriate product technical data sheets, over approved metal roof substrates in acceptable condition.

1.02 REFERENCES

- A. ASTM D 1079 – Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials.
- B. ASTM D1644 – Standard Test Methods for Nonvolatile Content of Varnishes
- C. ASTM D2697 – Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings
- D. ASTM D2370 – Standard Test Method for Tensile Properties of Organic Coatings
- E. ASTM D624 – Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
- F. ASTM D3960 – Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
- G. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.
- H. National Roofing Contractors Association (NRCA).

1.03 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual for definitions of roofing terms related to this section.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Provide product data sheets for each type of product indicated in this section.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Components listed shall be provided by a single manufacturer or approved by the primary roofing manufacturer.

1.06 PROJECT CONDITIONS

- A. Weather:
 - 1. Proceed with roofing only when existing and forecasted weather conditions permit.
 - 2. Application surface temperature shall be 40°F and rising. Care should be taken when coating surfaces above 120°F.
- B. Proceed with roofing work only when existing and forecasted weather conditions permit work to be performed in accordance with manufacturer recommendations and guarantee requirements as follows:

1.07 WARRANTY

- A. Manufacturers standard form, without monetary limitation, in which manufacturer agrees to repair leaks through the manufacturer's products on the roof caused by manufacturing defects, natural deterioration of, or workmanship in applying, the roofing system.

1. Warranty Duration:
 - a. Twenty (20) Years Labor and Material

PART 2 PRODUCTS

2.01 COATINGS

- A. Silicone Roof Coating: A solvent-based silicone coating that helps provide superior weatherproofing, ultraviolet resistance and biological resistance for a variety of substrates.
 1. Application Rate: 1.0 to 1.5 gal per 100 ft² per coat.
 2. Application Method: Airless sprayer, brush, or roller.
 3. Application Temperature (air, surface): 40°F - 110°F

2.02 FLASHINGS AND ACCESSORIES

- A. Silicone Mastic: a thick, high build silicone sealant.
 1. Application Rate: 2.5 - 4 gallons per 100 ft².
 2. Application Method: Trowel or brush.
 3. Application Temperature (air, surface): 40°F - 110°F.
 4. Clean-up: Mineral Spirits.
- B. Fabric: tough, non-woven, stitch-bonded, polyester fabric designed for use as a reinforcing material in manufacturer's coatings or systems.
- C. Seam Tape: A coat-able fabric surface backed with a polymer modified butyl adhesive. It is designed for application to a wide range of substrates where additional strength is required over loose or open seams and membrane tears.

2.03 PRIMERS AND SEALANTS

- A. Multi-Purpose Primer: Two-component, water-based epoxy, 9 to 1 ratio primer.
 1. Application Rate: varies depending on substrate, surface, and porosity.
 2. Application Method: Brush, roller or sprayer.
 3. Application Temperature (air, surface): 50°F – 120°F.
 4. Dry Time: 1 hour at 75°F, 50% relative humidity.
- B. Bonding Primer: Two-component, epoxy polyamide penetrating primer and sealer specially formulated to penetrate, prime and seal porous substrates and non-ferrous metal.
 1. Application Rate: depending on substrate porosity.
 2. Application Method: Brush, roller, or sprayer.
 3. Application Temperature (air, surface): 40°F – 110°F.
 4. Dry Time: 75°F, 50% relative humidity

PART 3 EXECUTION

3.01 SUBSTRATE CONDITIONS

- A. Installer shall verify adhesion.
- B. Follow manufacturer's substrate preparation guidelines.

3.02 PREPARATION OF SUBSTRATE

- A. Preparation of the roof substrate is the responsibility of the Installer. Installer shall address and correct all of the conditions listed in this section. Examine substrates to receive new roofing. Do not proceed with installation of the manufacturer's silicone coating until unsatisfactory conditions have been corrected in a manner acceptable to the manufacturer.
- B. Repair of Dented / Damaged Panels: Installer shall repair dented and/or damaged metal roof panels. Dents shall be mechanically removed to the maximum extent possible.
- C. Re-tightening and Replacement of Fasteners: All fasteners shall be re-tightened, secured or replaced, as necessary. All stripped fasteners shall be replaced with larger diameter fasteners, and the area re-secured by adding a new fastener next to the one that was stripped.
- D. Thorough Cleaning / Removal of Existing Paints and Coatings: Metal substrate shall be power washed with water. A minimum working pressure shall be used to remove all delaminating paint and coatings dirt, dust, and waste products (oil, oil-based roof cements, solvents, grease, animal fats, etc.).
- E. Treatment of Rust Areas: Remove all loose, flaking or powdery rust by wire brushing if it has not been removed during the pressure washing. Roof panels which are corroded to the point where holes are present shall be replaced.
- F. Priming of Pre-Finished Metal Panels: Where roof panel surfaces are known or suspected to contain Kynar-500, other fluoropolymers or silicone, test patches shall be prepared with and without the use of multi-purpose primer.

3.03 FLASHING APPLICATION

- A. After completion of substrate preparation, all flashing details, horizontal seams, penetrations and curbs shall be treated with silicone mastic in accordance with manufacturer's specifications. Flashing shall be feathered at the edges to ensure that water flows over the various flashing details
- B. Rakes: All fixed rake details for the roof shall be secured and sealed with a 12 inches minimum width of silicone mastic. If the fixed rake metal is fastened to the top of roof panel ribs and extends back onto the roof, trim off any excess metal and follow horizontal seam flashing procedures. All voids and open areas shall be filled with polyurethane foam prior to application of and silicone mastic.
- C. Penetrations: silicone mastic shall be applied around the base of all penetrations, extending at least 6 inches onto the vertical and 6 inches onto the base. Both the top and bottom of neoprene pipe boots shall be flashed using silicone mastic.
- D. Treat seams:
 - 1. If horizontal seams have gaps larger than 1/8" when pressure is applied at the lower panel add additional stitch screws and treat with silicone mastic only.
 - 2. Overlap seams must be treated with silicone mastic. All other seams may forgo treatment if the seal/tape is intact on the seam or if they are double locked.
- E. Gutters: Trowel or brush apply silicone mastic to the interior or exterior gutters incorporating fabric at all gutter seams. Gutter shall be completely clean and dry before applying silicone mastic.

3.04 FIELD OF ROOF APPLICATION AND RATES

- A. 20-year system:
 - 1. Apply first coat of silicone roof coating. Allow to dry (enough to walk on), and then inspect for defects, flaws or areas of insufficient coverage. Correct any unsatisfactory conditions prior to installing subsequent coats.
 - 2. Apply a second coat of silicone roof coating. Allow coating to dry (enough to walk on), and then inspect for defects, flaws or areas of insufficient coverage. Correct any unsatisfactory conditions.
 - 3. Apply third coat of silicone roof coating. Allow to dry (enough to walk on), and then inspect for defects, flaws or areas of insufficient coverage. Correct any unsatisfactory conditions prior to installing subsequent coats.
 - 4. Total thickness shall be 40 dry mils.

3.07 REPAIRS

- A. In the event that the silicone roof coating is damaged or punctured, repairs are to be performed as follows:
1. Damaged areas are to be cut, cleaned and dried.
 2. Apply silicone roof coating and feather out onto the existing silicone roof coating.
 3. If a new penetration area has been cut, embed fabric into the silicone roof coating or seam tape according to manufacturer's specifications.

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Formed roof-drainage sheet metal fabrications.
 - 2. Formed low-slope roof sheet metal fabrications.
 - 3. Formed wall sheet metal fabrications.

1.2 ACTION SUBMITTALS

- A. Product Data: For each of the following
 - 1. Underlayment materials.
 - 2. Butyl sealant.
- B. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

2.2 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil.
 - 2. Exposed Coil-Coated Finish:
 - 3. Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.
- C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- E. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.
- F. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
 - 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 - 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
 - 1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Seams:
 - 1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- 1. Fabricate from the following materials:
- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight.
 - 1. Fabricate from the following materials:

- a. Aluminum: 0.050 inch thick.
 - b. Galvanized Steel: 0.040 inch thick.
 - C. Base Flashing: Fabricate from the following materials:
 - 1. Aluminum: 0.040 inch thick.
 - 2. Galvanized Steel: 0.028 inch thick.
 - D. Counterflashing: Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
 - 2. Galvanized Steel: 0.022 inch thick.
 - E. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.
- 2.8 WALL SHEET METAL FABRICATIONS
- A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
 - 2. Galvanized Steel: 0.022 inch thick.

PART 3 - EXECUTION

- 3.1 INSTALLATION OF UNDERLAYMENT
- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.
 - 1. Install in shingle fashion to shed water.
 - 2. Lap joints not less than 2 inches.
 - B. Self-Adhering, High-Temperature Sheet Underlayment:
 - 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 - 2. Prime substrate if recommended by underlayment manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 - 4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
 - 5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
 - 6. Roll laps and edges with roller.
 - 7. Cover underlayment within 14 days.
 - C. Install slip sheet, wrinkle free, before installing sheet metal flashing and trim.
 - 1. Install in shingle fashion to shed water.
 - 2. Lapp joints not less than 4 inches.
- 3.2 INSTALLATION, GENERAL
- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
 - 1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
 - 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 - 5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
 - 6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 - 8. Do not field cut sheet metal flashing and trim by torch.
 - B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous

coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
 1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 1. Use sealant-filled joints unless otherwise indicated.
 - a. Form joints to completely conceal sealant.
 - b. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
 - c. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum or zinc where necessary for strength.

3.3 INSTALLATION OF ROOF FLASHINGS

- A. Roof Edge Flashing:
 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
- B. Copings:
 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
 1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 2. Extend counterflashing 4 inches over base flashing.
 3. Lap counterflashing joints minimum of 4 inches.
- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

3.4 INSTALLATION OF WALL FLASHINGS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.5 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.

3.7 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

- B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.
- END OF SECTION 076200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Latex joint sealants.
- 1.2 ACTION SUBMITTALS
 - A. Product data.

PART 2 - PRODUCTS

- 2.1 JOINT SEALANTS, GENERAL
 - A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
 - B. Colors of Exposed Joint Sealants: [As indicated by manufacturer's designations] [Match Architect's samples] [As selected by Architect from manufacturer's full range].
- 2.2 SILICONE JOINT SEALANTS
 - A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
- 2.3 LATEX JOINT SEALANTS
 - A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
- 2.4 JOINT-SEALANT BACKING
 - A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 - B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- 2.5 MISCELLANEOUS MATERIALS
 - A. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
 - B. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

- 3.1 PREPARATION
 - A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Masonry.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
- G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- H. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior standard steel doors and frames.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

1.3 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than those shown on the drawings when tested in accordance with ASTM C1363 or ASTM E1423.

2.2 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Standard-Duty Doors and Frames: ANSI/SDI A250.8, Level 1; ANSI/SDI A250.4, Level C.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: 1-3/8 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.032 inch.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard.
- C. Frames:
 - 1. Materials: Metallic-coated steel sheet, minimum thickness of 0.042 inch.
 - 2. Construction: Knocked down.

2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule on Drawings.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.

- g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: Manufacturer's standard.
 - 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Face welded.

2.4 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
 - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.6 FABRICATION

- A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 2. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

3.3 FIELD QUALITY CONTROL

- A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sectional-door assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
- B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: As indicated on Drawings.

2.2 SECTIONAL-DOOR ASSEMBLY

- A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
- B. Operation Cycles: Door components and operators capable of operating for not less than 10,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

- C. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with zinc coating.
 - 1. Door-Section Thickness: 1-3/8 inches minimum.
 - 2. Section Faces:
 - a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
 - b. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
 - 1) Surface: Manufacturer's standard
 - c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:
 - d. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile.
 - e. Hardware Locations: Provide reinforcement for hardware attachment.
- D. Track: Manufacturer's standard, galvanized-steel, standard-lift track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.
 - 1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
 - 2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
 - 3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
 - a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide intermittent jamb brackets attached to track and wall.
 - b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- E. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top and jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.
- F. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.
 - 1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.
 - a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
 - 2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.
 - 3. Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.
- G. Locking Device:
 - 1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
 - 2. Chain Lock Keeper: Suitable for padlock.
 - 3. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.
- H. Counterbalance Mechanism:
 - 1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
 - 2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
 - a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
 - 3. Cables: Galvanized-steel, multistrand, lifting cables.

4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.
- I. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 1. Comply with NFPA 70.
 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
 3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use.
 4. Usage Classification: Light duty, up to 10 cycles per hour.
 5. Operator Type: Manufacturer's standard for door requirements.
 - a. Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 6. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
 7. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
 - a. Monitored Entrapment Protection: Photoelectric sensor designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
 8. Control Station: Surface mounted, three-position (open, close, and stop) control.
 - a. Operation: Push button.
 - b. Interior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof-type, NEMA ICS 6, Type 4 enclosure.
 9. Emergency Manual Operation: Push-up type designed so required force for door operation does not exceed 25 lbf.
 10. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
 11. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- J. Metal Finish:
 1. Factory Prime Steel Finish: Compatible with field-applied finish and in manufacturer's standard color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.
- B. Tracks:
 1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.2 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hinges.
 - 2. Bored locks.
 - 3. Mortise locks.
 - 4. Electric strikes.
 - 5. Electromagnetic locks.
 - 6. Manual flush bolts.
 - 7. Lock cylinders.
 - 8. Key control cabinet.
 - 9. Operating trim.
 - 10. Wall- and floor-mounted stops.
 - 11. Thresholds.

1.2 PREINSTALLATION MEETINGS

- A. Keying Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product data.
- B. Shop Drawings: For electrified door hardware.
 - 1. Diagrams for power, signal, and control wiring.
 - 2. Details of interface of electrified door hardware and building safety and security systems.
- C. Door hardware schedule.
- D. Keying schedule.

1.4 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of door hardware from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.

2.3 HINGES

- A. Hinges: ANSI/BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

2.4 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.

- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Minimum 1/2-inch latchbolt throw.
 - 2. Deadbolts: Minimum 1-inch bolt throw.
 - C. Lock Backset: 2-3/4 inches unless otherwise indicated.
 - D. Lock Trim:
 - 1. Description: As indicated on Drawings.
 - 2. Levers: Cast.
 - 3. Dummy Trim: Match lever lock trim and escutcheons.
 - E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - F. Bored Locks: ANSI/BHMA A156.2, Grade 2, Series 4000.
- 2.5 ELECTRIC STRIKES
- A. Electric Strikes: ANSI/BHMA A156.31, Grade 2; with faceplate to suit lock and frame.
- 2.6 STANDARD CYLINDERS
- A. Standard Cylinders: Construction master key all cylinders. Stamp key control symbol in concealed place on each core. Equip locks with manufacturer's special pin tumbler cylinders that permit voiding construction keys without removal of the cylinder.
 - B. Provide one of the following manufacturers of cylinders:
 - 1. Medeco Key System – No Substitutions
 - C. Keying: Set locks and cylinders to the Owner the final keying requirements. Key system summary, cover sheet, and letter of authorization shall accompany keying schedule and purchase order sent to factory.
 - D. Provide one of the following systems:
 - 1. Medeco Key Systems – Medeco 3 system - No Substitutions
 - 2. Existing key system and new permanent cores by:
 - a. Security Lock & Key of Virginia
 - b. Contact: John Perdue
 - E. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
- 2.7 KEYING
- A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.
 - B. Keys: Brass.
- 2.8 KEY CONTROL SYSTEM
- A. Key Control Cabinet: ANSI/BHMA A156.28; metal cabinet with baked-enamel finish, containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
 - 1. Wall-Mounted Cabinet: Grade 2 cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
- 2.9 SURFACE CLOSERS
- A. Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- 2.10 MECHANICAL STOPS AND HOLDERS
- A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16.
- 2.11 THRESHOLDS
- A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.

2.12 FINISHES

- A. Provide finishes complying with ANSI/BHMA A156.18 as indicated in door hardware schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
1. Replace construction cores with permanent cores as indicated in keying schedule.
- E. Key Control System:
1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
1. Do not notch perimeter gasketing to install other surface-applied hardware.
- J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.2 ADJUSTING

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

END OF SECTION 087100

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Interior gypsum board.

- 1.2 ACTION SUBMITTALS
 - A. Product data.

PART 2 - PRODUCTS

- 2.1 GYPSUM BOARD, GENERAL
 - A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- 2.2 INTERIOR GYPSUM BOARD
 - A. Gypsum Wallboard: ASTM C1396/C1396M.
 - 1. Long Edges: Tapered.
- 2.3 TRIM ACCESSORIES
 - A. Interior Trim: ASTM C1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
- 2.4 JOINT TREATMENT MATERIALS
 - A. General: Comply with ASTM C475/C475M.
 - B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 4 finish, use setting-type, sandable topping compound.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELS

- A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- B. Comply with ASTM C840.
- C. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

3.2 FINISHING OF GYPSUM BOARD

- A. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- B. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

3.3 APPLICATION OF TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

3.4 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Acoustical tiles.
 - 2. Metal suspension system.
 - 3. Accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class C in accordance with ASTM E1264.
 - 2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL TILES

- A. Acoustical Tile Standard: Manufacturer's standard tiles of configuration indicated that comply with ASTM E1264.
- B. Color: White.
- C. Edge/Joint Detail: Square, kerfed, and rabbeted; tongue and grooved; or butt.
- D. Thickness: 5/8 inch.
- E. Modular Size: As indicated on Drawings.

2.3 METAL SUSPENSION SYSTEM

- A. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, fully concealed, metal suspension system that complies with applicable requirements in ASTM C635/C635M.

2.4 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical tiles in-place during a seismic event.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated.
- B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

- A. Install suspended acoustical tile ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.
 - 1. Do not use exposed fasteners, including pop rivets, on moldings and trim.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vinyl base.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 VINYL BASE

- A. Product Standard: ASTM F1861, Type TV (vinyl, thermoplastic).
 - 1. Group: I (solid, homogeneous) or II (layered).
 - 2. Style: Cove.
- B. Minimum Thickness: 0.080 inch.
- C. Height: 4 inches.
- D. Lengths: Coils in 4' length.
- E. Outside Corners: Job formed or preformed.
- F. Inside Corners: Job formed or preformed.
- G. Colors and Patterns: As indicated by manufacturer's designations.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Preformed Corners: Install preformed corners before installing straight pieces.
- G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Primers.
 - 2. Finish coatings.
- 1.2 ACTION SUBMITTALS
 - A. Product Data: For each type of product.

PART 2 - PRODUCTS

- 2.1 PAINT PRODUCTS, GENERAL
 - A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.
 - B. Colors: As selected by Owner from manufacturer's full range.
- 2.2 PRIMERS
 - A. Exterior, Alkali-Resistant, Water-Based Primer: Pigmented, water-based primer formulated for use on alkaline surfaces, such as exterior plaster, vertical concrete, and masonry.
 - B. Surface-Tolerant Metal Primer: Corrosion-resistant, solvent-based metal primer formulated for use on structural steel and metal fabrications that have been minimally prepared.
- 2.3 FINISH COATINGS
 - A. Exterior Latex Paint, Low Sheen: Water-based, pigmented coating; formulated for alkali, mold, microbial, and water resistance and for use on exterior surfaces, such as portland cement plaster, concrete, and primed wood.
 - 1. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.
 - B. Exterior Latex Paint, Semigloss: Water-based, pigmented emulsion coating formulated for alkali, mold, microbial, and water resistance and for use on exterior surfaces, such as masonry, portland cement plaster, and primed wood and metal.
 - 1. Gloss and Sheen Level: Manufacturer's standard semi-gloss finish.
 - C. Exterior, Water-Based, Light Industrial Coating, Semigloss: Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior, primed, wood and metal surfaces.
 - 1. Gloss Level: Manufacturer's standard semigloss finish.
 - D. Exterior Alkyd Enamel, Semigloss: Solvent-based, pigmented, alkyd enamel formulated for mold, microbial, and water resistance and for use on exterior, primed, wood and metal surfaces.
 - 1. Gloss Level: Manufacturer's standard semigloss finish.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.
 - B. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

3.3 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions.
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Primers.
 - 2. Water-based finish coatings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range.

2.2 PRIMERS

- A. Interior, Institutional Low-Odor/VOC Primer Sealer: Water-based primer sealer with low-odor characteristics and a VOC of less than 10 grams per liter for use on new interior plaster, concrete, and gypsum wallboard surfaces that are subsequently to be painted with latex finish coats.
- B. Alkali-Resistant, Water-Based Primer: Water-based primer formulated for use on alkaline surfaces, such as plaster, vertical concrete, and masonry.

2.3 WATER-BASED FINISH COATS

- A. Interior, Latex, Low Odor/VOC, Eggshell: Two (2) coats White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter.
 - 1. Gloss and Sheen Level: Manufacturer's standard eggshell finish.
- B. Interior, Latex, Low Odor/VOC, Semigloss: Two (2) coats White or colored latex paint with low-odor characteristics and a VOC of less than 10 grams per liter.
 - 1. Gloss and Sheen Level: Manufacturer's standard semigloss finish.
- C. Interior, Acrylic Enamel, Gloss: Two (2) coats white or colored acrylic paint with low-odor characteristics suitable for application onto existing and new door frames. Existing frames shall be free of paint chipping with a prepared smooth finish.
 - 1. Gloss and Sheen Level: Manufacturer's standard gloss finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- B. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
- C. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.3 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. Gypsum Board Substrates:
 - 1. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Interior, institutional low-odor/VOC primer sealer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, latex, institutional low odor/VOC, eggshell.

END OF SECTION 099123

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Private-use bathroom accessories.
 - 3. Custodial accessories.

1.2 ACTION SUBMITTALS

- A. Product data.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Grab Bar:
 - 1. Mounting: Flanges with concealed fasteners.
 - 2. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 - 3. OD: 1-1/4 inches.
 - 4. Configuration and Length: As indicated on Drawings.

2.3 SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C1503.
- B. Annealed Monolithic Glass Mirrors: Mirror Select Quality, clear.
 - 1. Nominal Thickness: 5.0 mm.
- C. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.
 - 1. Nominal Thickness: 5.0 mm.
- D. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
 - 1. Aluminum J-Channel Bottom and Side Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.
 - 2. Aluminum J-Channel Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.
 - 3. Finish: Clear bright anodized.
- E. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

2.4 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.5 CUSTODIAL ACCESSORIES

A. Custodial Mop and Broom Holder:

1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
2. Length: 36 inches.
3. Hooks: Four.
4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.
 - b. Rod: Approximately 1/4-inch-diameter stainless steel.

2.6 FABRICATION

- A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.

END OF SECTION 102800

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- 1.2 ACTION SUBMITTALS
 - A. Product Data: For each type of product.
- 1.3 INFORMATIONAL SUBMITTALS
 - A. Warranty: Sample of special warranty.
- 1.4 WARRANTY
 - A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
 - A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
 - B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- 2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS
 - A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
 - B. Regular Dry-Chemical Type: UL-rated 5-pound nominal capacity, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.
- 2.3 MOUNTING BRACKETS <Insert drawing designation>
 - A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 - EXECUTION

- 3.1 INSTALLATION
 - A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
 - B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 123530 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Kitchen cabinets.
- 1.2 ACTION SUBMITTALS
 - A. Product Data: For each type of product.
 - B. Shop Drawings: For residential casework. Include plans, elevations, details, and attachments to other work.
 - C. Samples: For casework and hardware finishes.
- 1.3 INFORMATIONAL SUBMITTALS
 - A. Product Certificates: For casework.
- 1.4 FIELD CONDITIONS
 - A. Environmental Limitations without Humidity Control: Do not deliver or install wood casework until wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

PART 2 - PRODUCTS

- 2.1 CABINETS
 - A. Quality Standard: Provide cabinets that comply with KCMA A161.1.
 - B. Door and Drawer Face Style: Flush overlay.
 - 1. Door and Drawer Fronts:
 - 2. 1/2-inch-thick, plastic-laminate-faced particleboard.
 - C. Cabinet Style: Frameless.
 - D. Exposed Cabinet End Finish: Plastic laminate.
- 2.2 CABINET MATERIALS
 - A. Hardwood Lumber: Kiln dried to 7 percent moisture content.
 - B. Softwood Lumber: Kiln dried to 10 percent moisture content.
 - C. Particleboard: ANSI A208.1, Grade M-2.
 - D. MDF: Medium-density fiberboard, ANSI A208.2, Grade MD.
 - E. Exposed Materials:
 - 1. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS and edgebanded.
 - a. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.
 - b. Plastic-Laminate Edgebanding: Of same grade, pattern, color, and texture of plastic laminate as for faces.
 - F. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; MDF; or hardboard.
- 2.3 CABINET HARDWARE
 - A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.
 - B. Pulls: Wire pulls.
 - C. Hinges: Concealed European-style, self-closing hinges.
 - D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or Type B05091.

- E. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.
 - 1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
 - 2. Drawers: Provide one bumper on back side of drawer front at each corner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install casework with no variations in adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework.
- B. Install casework without distortion so doors and drawers fit the openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.
- C. Install casework level and plumb to a tolerance of 1/8 inch in 8 feet.
- D. Fasten casework to adjacent units and to backing.
- E. Adjust hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- F. Clean casework on exposed and semiexposed surfaces. Touch up as required to restore damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 123530

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Plastic-laminate-clad countertops.
 - 2. Accessories.
- 1.2 ACTION SUBMITTALS
 - A. Product Data: For each type of product.
 - B. Shop Drawings: For plastic-laminate-clad countertops.
 - 1. Apply AWI Quality Certification Program label to Shop Drawings.
 - C. Samples: Plastic laminates in each type, color, pattern, and surface finish required.
- 1.3 INFORMATIONAL SUBMITTALS
 - A. Product Certificates: For the following:
 - 1. Composite wood products.
 - 2. High-pressure decorative laminate.
 - 3. Adhesives.
 - B. Quality Standard Compliance Certificates: AWI Quality Certification Program.
- 1.4 FIELD CONDITIONS
 - A. Environmental Limitations without Humidity Control: Do not deliver or install wood countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

PART 2 - PRODUCTS

- 2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS
 - A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.
 - 1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that countertops comply with requirements of grades specified.
 - B. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As selected by Architect from manufacturer's full range in the following categories:
 - a. Solid colors, matte finish.
 - b. Solid colors with core same color as surface, matte finish.
 - C. Edge Treatment: Same as laminate cladding on horizontal surfaces.
 - D. Core Material: Particleboard or MDF.
 - E. Core Material at Sinks: Particleboard made with exterior glue.
 - F. Core Thickness: 3/4 inch.
 - 1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.
- 2.2 WOOD MATERIALS
 - A. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
 - 1. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.
 - 2. Particleboard: ANSI A208.1, Grade M-2.
 - 3. Softwood Plywood: DOC PS 1.

2.3 ACCESSORIES

- A. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Outside Diameter: 2 inches.
 - 2. Color: Black,

2.4 MISCELLANEOUS MATERIALS

- A. Adhesive for Bonding Plastic Laminate: Type I waterproof type as selected by fabricator to comply with requirements.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
 - 1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
- B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 - 1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
 - 2. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.
- F. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 123623.13

SECTION 133419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural-steel framing.
 - 2. Metal roof panels.
 - 3. Metal wall panels.
 - 4. Thermal insulation.
 - 5. Accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
- B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and attachments to other work.
- C. Samples: For units with factory-applied finishes.
- D. Delegated Design Submittals: For metal building systems.
 - 1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - 1. Name and location of Project.
 - 2. Order number.
 - 3. Name of manufacturer.
 - 4. Name of Contractor.
 - 5. Building dimensions including width, length, height, and roof slope.
 - 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - 7. Governing building code and year of edition.
 - 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 - 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- C. Material test reports.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Accreditation: Manufacturer's facility accredited according to IAS AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
 - 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- 1.6 WARRANTY
 - A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
 - A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.
 - B. Structural Performance: Metal building systems to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection and Drift Limits:
 - a. Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
 - 1) Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - D. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
 - E. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
 - F. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
 - G. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
 - H. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - I. Thermal Performance for Opaque Elements: Provide the following maximum U-factors and minimum R-values when tested according to ASTM C1363 or ASTM C518:
- 2.2 STRUCTURAL-STEEL FRAMING
 - A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
 - B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
 - D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters and rake beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - 2. Frame Configuration: Single gable.
 - 3. Exterior Column: Tapered.
 - 4. Rafter: Tapered.

- E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
- F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
- G. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.

2.3 METAL ROOF PANELS

- A. Standing-Seam, Vertical-Rib, Metal Roof Panels: Formed with interlocking ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
 - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Exterior Finish: Two-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 2. Clips: Two-piece floating to accommodate thermal movement.
 - 3. Joint Type: Panels snapped together.
 - 4. Panel Coverage: 24 inches.
 - 5. Panel Height: 2 inches.

2.4 METAL WALL PANELS

- A. Concealed-Fastener, Flush-Profile, Metal Wall Panels: Formed with vertical panel edges and a single wide recess, centered between panel edges; with flush joint between panels; with 1-inch-wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps.
 - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Exterior Finish: Fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 2. Panel Coverage: 16 inches.
 - 3. Panel Height: 3 inches.

2.5 THERMAL INSULATION

- A. Faced Metal Building Insulation: ASTM C991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch-wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
- B. Retainer Strips: For securing insulation between supports, 0.025-inch nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.
- C. Vapor-Retarder Facing: ASTM C1136, with permeance not greater than 0.02 perm when tested according to ASTM E96/E96M, Desiccant Method.

2.6 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
- D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.

- E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
 - 1. Gutter Supports: Fabricated from same material and finish as gutters.
 - 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.
 - 1. Mounting Straps: Fabricated from same material and finish as gutters.

2.7 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members to be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.8 SOURCE QUALITY CONTROL

- A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.
- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.

- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
 - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
 - G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
 - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 - 2. Locate and space wall girts to suit openings such as doors and windows.
 - 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, ventilators, and other penetrations of roof and walls.
 - H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
 - 1. Tighten rod and cable bracing to avoid sag.
 - 2. Locate interior end-bay bracing only where indicated.
 - I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
 - J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.
- 3.2 METAL PANEL INSTALLATION, GENERAL
- A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 - 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
 - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Locate metal panel splices over structural supports with end laps in alignment.
 - 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
 - B. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
 - 1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 - C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
 - D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
 - 1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
- 3.3 METAL ROOF PANEL INSTALLATION
- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
 - 1. Install ridge caps as metal roof panel work proceeds.
 - 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
 - B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
 - 1. Install clips to supports with self-drilling or self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
 6. Provide metal closures at peaks rake edges rake walls and each side of ridge caps.
 - C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
 1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
 4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
 - D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- 3.4 METAL WALL PANEL INSTALLATION
- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 2. Shim or otherwise plumb substrates receiving metal wall panels.
 3. When two rows of metal panels are required, lap panels 4 inches minimum.
 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
 6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 7. Install screw fasteners in predrilled holes.
 8. Install flashing and trim as metal wall panel work proceeds.
 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
 - B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
- 3.5 THERMAL INSULATION INSTALLATION
- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
 1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
 2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
 3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
 - B. Blanket Roof Insulation: Comply with the following installation method:

1. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
 - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
 2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
 - C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
 1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
- 3.6 ACCESSORY INSTALLATION
- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
 - B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
 - C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
 - D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
 1. Tie downspouts to underground drainage system indicated.
 - E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.
- 3.7 FIELD QUALITY CONTROL
- A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.
 - B. Product will be considered defective if it does not pass tests and inspections.
 - C. Prepare test and inspection reports.
- END OF SECTION 133419

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.
- B. Work Included:
 - 1. Prepare and paint Division 23 equipment, accessories, ductwork, piping, and miscellaneous materials located in Equipment Rooms, Boiler Rooms, pipe trenches and other utility areas housing mechanical equipment and materials.
 - 2. Identification of piping in exposed and accessible locations.
 - 3. Marking and designation of equipment.
- C. Work Not Included:
 - 1. Painting of ductwork, piping or equipment located on the building exterior.
 - 2. Painting of ductwork, piping or equipment exposed in finished areas other than those listed under WORK INCLUDED above.
 - 3. Painting of existing equipment, piping or ductwork.
- D. Related Sections:
 - 1. Section 09 90 00 – Painting and Coating
 - 2. Section 23 00 10 – HVAC General Requirements
 - 3. Section 23 05 00 – Common Work Results for HVAC
 - 4. Section 23 07 00 – HVAC Insulation
 - 5. Section 23 09 00 – Instrumentation and Control for HVAC
 - 6. Section 23 20 00 – HVAC Piping
 - 7. Section 23 30 00 – HVAC Air Distribution
 - 8. Section 23 70 00 – Central HVAC Equipment
 - 9. Section 23 80 00 – Decentralized HVAC Equipment
 - 10. Division 26 - Electrical

1.02 REFERENCED STANDARDS

- A. General: The following standards or codes (latest edition) form a part of this specification to the extent indicated by the reference thereto.
- B. American National Standards Institute (ANSI):
 - 1. ANSI A13.1 Scheme for Identification of Piping Systems
- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
 - 2. ASTM C 411 Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
- D. National Fire Protection Association (NFPA):
 - 1. Standard 255 Method of Test of Surface Burning Characteristics of Building Materials
- E. Underwriters Laboratories, Inc. (UL)

1. Standard 723 Tests for Surface Burning Characteristics of Building Materials

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Except as otherwise specified, materials shall be the products of the following manufacturers:
 1. Sherwin-Williams
 2. Pratt and Lambert
 3. Pittsburgh Paints (PPG)
 4. Benjamin Moore
 5. Porter Paints
 6. Seton Identification Products

2.02 MATERIALS

- A. Deliver all paints and materials to the project site in their unopened original containers with all labels intact and legible at the time of use.
- B. All coatings exposed to supply and return airstreams and where applied to exposed surfaces in a return air plenum, shall have a composite flame spread rating not exceeding 25, and a smoke developed rating not exceeding 50 as tested under procedure ASTM E-84-75, NFPA 255 and UL 723. Coatings shall not flame, glow, smolder or smoke when tested in accordance with ASTM C411, latest edition.
- C. Sherwin-Williams Industrial Maintenance Coatings System 4000 products are listed below to establish color and a standard of quality.
 1. All Hangers and Supports: One coat Series 54 Gloss Black Alkyd Enamel.
 2. All major items of equipment and equipment supports including boilers, compressors, pumps, tanks, air handling units, condensers, fans and all other similar items shall be painted as follows:
 - a. Uninsulated hot surfaces on equipment, operating at or above 150°F, shall be painted with two coats of No. B59S8 Heat Resistant Aluminum.
 - b. Other equipment surfaces of aluminum, iron and steel shall be primed with one coat of No. B50Y1 Zinc Chromate Primer. Galvanized surfaces shall be chemically prepared and primed with one coat of Galvite B50W3 Primer. Field insulated surfaces shall be primed with No. B28W200 Wall Primer. Where equipment is furnished with factory prime or finish coat, only patch priming is required at any damaged areas before finish coats are applied. Finish all equipment with two coats of Series 54 Alkyd Gloss Enamel, No. SW4063 Robotic Blue. Exterior of belt guards and other protective guards shall be finished with two coats of Series 54 Alkyd Gloss Enamel, No. SW4084 safety yellow color. Interior of and all items covered by belt guards and other protective guards shall be finished with two coats of No. SW4083 safety orange color.
 - c. Nameplates and Testing Agency Labels on equipment or machinery shall not be painted.
 3. Ducts:
 - a. Interior duct behind all grilles, registers and diffusers shall be painted with one coat of flat black prime or flat black finish paint.
 - b. Exposed in equipment rooms and other unfinished areas such as storage areas and utility type spaces; uninsulated galvanized steel ducts shall be chemically prepared and primed with one coat of Galvite B50W3 Primer. Aluminum ducts and insulated ducts with aluminum jacket shall be primed with one coat of No. B50Y1 Zinc Chromate Primer. Canvas or paper insulation jacket shall be primed with one coat of No. B28W200 Wall Primer. Finish with Series 54 Alkyd Gloss Enamel,

- gray No. SW4028 Gypsum applied in sufficient number of coats to effectively cover the prime coat.
4. Piping: Exposed in equipment rooms and where connections are made to equipment located in storage rooms and other utility type areas.
 - a. Priming:
 - 1) Insulation Canvas or Paper Jacket: One coat No. B28W200 Wall Primer.
 - 2) Insulation Aluminum Jacket: One coat No. B50Y1 Zinc Chromate Primer.
 - 3) Bare Iron or Steel or Copper: One coat No. B50Y1 Zinc Chromate Primer.
 - 4) Galvanized Steel: Pipes and ductwork shall be chemically prepared and primed with one coat of Galvite B50W3 Primer.
 - 5) Asphalt Coated Pipe: One coat No. B28W200 Wall Primer.
 - b. Finish: All pipe lines and the supports or hangers therefore, shall be finished with Series 54 Alkyd Gloss Enamel, gray No. SW4028 Gypsum applied in sufficient number of coats to effectively cover the prime coat. Painting of pipe hangers is specified hereinbefore.
 - c. Materials shall be as recommended by the manufacturer for the surface to be finished.
 - d. Unless otherwise specified, primer shall be by the same manufacturer as the finish coat.
 - e. Materials shall not be thinned or cut except as recommended by the coating manufacturer. Thinners shall be by the same manufacturer as the primer and finish coat.
 - D. Valve tags shall be neat circular brass with designations stamped thereon, attached with solid brass jack chain to each valve stem or handle.
 - E. Each item of equipment such as pumps, air handlers, etc., and equipment control devices such as motor starters, disconnect switches, etc. shall be properly marked with laminated engraved plastic nameplates fastened with sheet metal screws, bolts or permanent adhesive. Pressure sensitive tape is not acceptable.
 - F. All piping, insulated and uninsulated, shall be identified with Seton Ultra-Mark or equal wrap around piping system markers and arrow flow directional marker. Markers shall be pre-coiled, semi-rigid plastic or polyester with sealed color graphics. Markers shall be minimum 12 inches long with 1-¼ inch high letters, formed to cover entire circumference of the pipe. Markers shall be attached to piping using plastic tie wraps. Pipe identification shall use the same designations or abbreviations used on the drawings. Marker colors shall be in accordance with ANSI.

PART 3 EXECUTION

3.01 WORKMANSHIP

- A. The work shall be accomplished by qualified mechanics skilled in the painting trade. Painting of equipment, piping, ductwork and other materials shall not commence until all testing is complete and systems are ready for operation. Materials shall be applied according to manufacturer's directions. All containers shall be securely closed when not in use. Flammable materials shall not be stored on premises. Flammable waste shall be disposed of daily in devices approved for such purposes. Materials shall be evenly spread, and smoothly flowed on without runs or sags. Each coat shall be thoroughly dry before application of succeeding coats.

3.02 PROTECTION OF WORK

- A. The painters shall protect all adjacent surfaces with drop covers during the process of painting. Upon completion, paint spots, if any, shall be removed from all surfaces.

3.03 PREPARATION OF SURFACE

- A. Surfaces to be painted shall be completely dry before applying paint. Metal surfaces shall be cleaned with mineral spirits before applying materials. Rust and scale shall be removed by wire brushing or sanding. Galvanized surfaces shall be chemically pretreated with crystalline (zinc phosphate) phosphate in strict accordance with the manufacturer's recommendations. Surfaces shall not be painted when the temperature is, or is likely to be, near the freezing point, nor when they are exposed to hot sun.

3.04 IDENTIFICATION OF PIPES AND EQUIPMENT

- A. Equipment: After all other painting is completed, each major item of equipment shall be properly identified with nameplates. Identification symbols and designations shall be the same as shown on the Contract Documents. Where equipment is installed above lay-in ceilings (VAV boxes, cabinet unit heaters, fan coil units, or similar), the plastic nameplate shall be adhered to the face of the T-bar support so that it can be identified from within the space.
- B. Dampers: The location of all manual volume air dampers shall be identified where located above a ceiling. The contractor shall provide a label on the T-bar support directly below the damper location to identify the damper location. Labels shall be vinyl tape with ID: MVD.
- C. Apply piping system markers after completion of required insulation and finishes on piping systems. Markers shall be applied in the following locations and where identified by the Engineer:
 - 1. At each valve and at connection to equipment.
 - 2. At every tee and branch connection.
 - 3. At each riser including branch risers from mains.
 - 4. At each side of a pipe passage through floors, walls and partitions.
 - 5. Every 15 feet on straight runs of piping mains and branches.
 - 6. Within 6 feet of elbows (each side).
 - 7. At access doors or similar points that permit view of concealed piping.
 - 8. Markers shall be provided on all piping above lay-in ceilings.
 - 9. Provide arrow markers showing direction of flow incorporated into, or adjacent to, each piping system marker.
 - 10. Apply all piping system markers where view is unobstructed, and legends can be read and easily identified.
 - 11. Apply all tags and piping system markers in accordance with the supplier's instructions.

END OF SECTION

SECTION 23 0900
INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

- A. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.
- B. Work Included:
 - 1. Complete System of Automatic Controls
 - 2. Electric Appurtenances
 - 3. Direct Digital Controls (DDC)
- C. Related Sections:
 - 1. Section 23 00 10 – HVAC General Requirements
 - 2. Section 23 01 00 – Operation and Maintenance of HVAC Systems
 - 3. Section 23 05 00 – Common Work Results for HVAC
 - 4. Section 23 05 53 – Identification for HVAC Piping and Equipment
 - 5. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC
 - 6. Section 23 20 00 – HVAC Piping
 - 7. Section 23 30 00 – HVAC Air Distribution
 - 8. Section 23 70 00 – Central HVAC Equipment
 - 9. Division 26 - Electrical

1.02 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 23 00 10.
- B. Provide complete shop drawings, catalog data sheets and such other data necessary to fully describe and substantiate compliance with these specifications for all control items and systems included in this section.
- C. Shop drawings shall indicate the exact location(s) of the outdoor temperature sensor(s).
- D. Operation and maintenance data shall be submitted for all items of equipment and materials indicated in this Section.
- E. Application Software Documentation: Contractor shall provide a blueprint documentation of the software application program for each stand-alone digital controller. Documentation shall include block software flowchart showing the interconnection between each of the control algorithms and sequences. A program listing shall be printed on the same blueprint, along with the program flowchart, and description of the sequence of operation. This blueprint shall be stored and maintained in each stand-alone digital controller. System acceptance shall not be completed until this documentation is provided and located in each panel.

1.03 QUALITY ASSURANCE

- A. When all temperature controls have been installed, the temperature control contractor shall completely commission the system to verify that all systems and components are operating in accordance with the specifications. Where corrections or adjustments to the controlled

equipment are required, the temperature control contractor shall document such changes to the Contractor, and recheck the control system once the changes have been made.

1. All equipment and subsystems shall be operated through all specified modes of control and sequences of operation, including full load and part load conditions.
 2. All physical valve and damper positions shall be visually verified to correspond with the positions indicated by the controls software.
 3. All instrumentation shall be properly calibrated.
- B. Final point-to-point check-out and commissioning of the Temperature Control System shall be by the temperature control manufacturer or its exclusive authorized representative.

1.04 SCOPE OF WORK

- A. Provide a new building automation system (bas) to integrate and control all mechanical equipment.
- B. The building automation system shall be as indicated on the drawings and described in these specifications. System must be fully integrated and coordinated with mechanical equipment ddc controllers furnished and installed in the equipment manufacturer's factory as specified in those sections. The intent of the BAS is to integrate all mechanical equipment into one system for global monitoring, control, and alarming associated with the building. It is the bas manufacturer's responsibility to provide all the design, engineering, and field coordination required to ensure all equipment sequence of operations are met as specified and the designated BAS operators have the capability of managing the building mechanical system to ensure occupant comfort while maintaining energy efficiency.
- C. ASSOCIATED WITH THIS PROJECT.
1. The Temperature Controls Subcontractor shall provide technical support for the Testing and Balancing Subcontractor. The technicians shall be fully qualified in all aspects of the system and shall have extensive knowledge of the project. Support shall include, but not be limited to the following:
 2. Assistance in determining air systems pressure setpoints.
 3. Assistance in determining proper automatic damper positions for all air handling units, and air conditioning units.
 4. Simulating conditions as necessary for proper and optimized testing and balancing of the air and hydronic systems.
- D. Programming shall be provided in accordance with commonly accepted industry standards and practices to ensure proper and efficient control of all equipment and systems. Where Application Specific Digital Controllers with factory programming are not capable of operating systems in the sequence described herein, the Contractor shall provide a digital controller with custom programming.
- E. Programming shall be provided to accomplish the sequence of operations as described in on drawings M4.01 and M4.02.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Component parts of this system shall be manufactured by Trane as basis of design.

- B. Installation shall be by qualified employees or authorized representative of the temperature control manufacturer. Temperature control work by independent contractors performing work without direct supervision from the authorized representative will not be accepted.

2.02 SYSTEM REQUIREMENTS

- A. The system shall be a complete system of automatic temperature regulation of the DDC type with electric and electronic accessories and components as indicated. The system shall be backwards-compatible with the Owner's existing operating and control systems.
- B. All control items except thermostats, sensors and transmitters located in rooms shall be properly identified with engraved plastic nameplates permanently attached. Room thermostats shall be labeling identifying unit association with vinyl tape.
- C. Room thermostat, sensor and transmitter locations shall be coordinated to align vertically or horizontally with adjacent light switches or control instruments. Room thermostats and sensors shall be mounted with bottom 5'-4" above the floor.
- D. All components and materials shall be UL or ASTM rated for use in air plenums.

2.03 MATERIALS

- A. Sensors, Transmitters and Thermostats:
 - 1. Temperature sensors for the Direct Digital Control (DDC) System shall be precision RTD's or thermistor. Accuracy shall be plus or minus 1 degree F over the entire control range. Sensors for pipe applications shall be immersion type, provided with pipe well. Sensors for duct application shall be of the averaging type, with a 5 foot or a 22 foot length element. Duct element length shall be adequate to serpentine across the entire duct area. Where sensors are located downstream of fans or at least 10 duct diameters downstream of coils, elbows, junctions, or dampers, single point sensors may be used. Outdoor temperature sensors shall be provided with sunshield of copper or painted aluminum on a northern exposure. Space temperature sensors shall be compatible with unit controller and shall be provided in a decorative metal or plastic enclosure. Sensors located in gymnasiums or multi-purpose rooms shall be provided with heavy-duty wire guards. Sensors located in public spaces such as corridors and public toilets shall be recessed type with flush mounted stainless steel blanking cover. Space sensors shall be provided with set-point adjustment and override slider switch.
 - 2. Provide thermostats with 2 degree deadband in occupied and unoccupied modes.
 - 3. High temperature thermostat for detection of excessive temperature in the duct shall be U.L. listed, manual reset type with an adjustable temperature setting. Set at 136°F.
 - 4. Low temperature thermostat for detection of low temperature in the duct shall be manual reset type with 20' temperature sensitive element, located downstream from the coil. If any portion of the element senses a temperature below its setting, the contacts shall break. Set at 35°F. Units shall be double pole for connection to the fan starter circuit and for monitoring by the DDC.
 - 5. Electric thermostats shall be line voltage type complete with auto-off switch. The thermostat shall be rated for 6 amps at 120 volts.
 - 6. Carbon dioxide sensors shall be auto-calibration type with LCD display. Units shall utilize non-dispersive infrared (NDIR) and shall have a range of 0-2000 ppm CO2. Units shall have accuracy of ±3%. Operating range shall be 32°F to 122°F. Outputs shall be 0-10 VDC or 4-20 mA. Unit housings shall be suitable for installation in return air plenums (where applicable) and shall have a standard one (1) year element warranty with lifetime warranty on calibration.
 - 7. Current relays shall be Hawkeye 700 Series or approved equal. Units shall be self-induced powered, solid state electronic with status and power LED's and binary output.

Units shall be automatically self adjusting to detect loss-of-load and under current conditions (broken belt, etc.) with a range of 3 to 135 amps. Units shall be suitable for use with variable frequency drives, automatically compensating for changes in frequency and voltage. Operating range shall be 5°F to 185°F. Units shall have a limited five (5) year warranty.

8. Airflow Measuring Stations shall be constructed of aluminum or stainless steel. Units shall be ASHRAE Traversing design with shrouded impact sensors, accuracy of $\pm 2\%$ and repeatability of $\pm 0.25\%$ at minimum airflow of 400 FPM and maximum airflow of 10,000 FPM. Units shall have 1/4 inch NPT pressure connections and shall be suitable for maximum 200°F airstream.
- B. Dampers and Damper Motors:
1. Control dampers shall be Ruskin Model CD36 manufactured specifically to control the air flow in heating, ventilating and air conditioning systems. Frames shall be made of galvanized sheet steel, formed into channels and riveted. In addition to the rigid frame construction, corner brackets shall be used to maintain alignment of the damper. Blades shall consist of formed galvanized sheets, formed for extra strength to withstand high velocities and static pressures. Square or hex blade pins shall be furnished to assure non-slip pivoting of the blades when a damper is used as a single module or is interconnected with others. Leakage shall be less than 4 CFM/square foot at 1" w.g. differential pressure for units of 48 inch width. Maximum blade width shall be 8".
 2. Damper actuators shall be provided for all automatic dampers. Damper actuators controlled from the DDC shall be electronic modulating type, low voltage, spring return and shall be of sufficient capacity to operate the connected damper. Outside air and relief air damper actuators shall be spring return normally closed. Line voltage motors shall be two-position type.
- C. Transformers are required for low voltage control items. Control manufacturer shall provide transformers with adequate capacity to operate connected equipment.
- D. Panels: Control cabinets shall be furnished for each a.c. unit, major equipment components and elsewhere as indicated. Control cabinets shall be fabricated of extruded aluminum or steel. The cabinets shall have a face panel for flush mounting gauges, switches, pilot lights, etc. and sub-panel for mounting controllers, relays, etc. Controls which require manual positioning or visual indication shall be flush mounted and identified with engraved nameplates on the face panel. Controls which are required to be accessible only for maintenance and calibration are to be mounted on the sub-panel in the cabinet. Each item shall be identified by engraved nameplates and shall include units served, power panel ID, and the circuit number. Refer to drawings M4.01 and M4.02 for additional information.
- E. Miscellaneous relays, transformers, switches and other devices shall be provided as required for the sequence of control indicated. Relays shall be located adjacent to the controlled device such as motor or motor starter. Relays may be located within starters and equipment control panels where space is available and where approved by NEC. Relays outside of the controlled device shall be provided with NEMA enclosure suitable for location where installed.
- F. Disconnect Switches shall be provided for each 120V power connection to Stand-Alone Digital Controllers, Application-Specific Digital Controllers and all other electronic devices provided under this Section.
- G. Direct Digital Control System:
- 1) Refer to drawings M4.01 and M4.02 for additional information.
- H. Application Specific Digital Controllers:
- a. Application Specific Digital Controllers (ASDC) with factory programming and no time clock may be provided for equipment such as VAV units, fan coil units, unit heaters, exhaust fans, small unitary equipment, etc. provided they are capable of

controlling the equipment in accordance with the Drawings and the specified sequence of operations. ASDC's shall be capable of receiving program changes and time functions via the LAN or communications link. ASDC's shall be capable of making monitored point available to the DDC.

- b. DDC control, monitoring and alarm functions may be extended to remote equipment by the use of ASDC's. Use of ASDC's shall be transparent to the central DDC without effect on DDC functions or color graphic displays.
 - c. Each ASDC shall be microprocessor based DDC and shall perform all sequences as indicated and shall communicate with all other DDC controllers via the LAN or communications link. Each ASDC shall also be capable of stand-alone operation and as directed by the central DDC system.
 - d. Each ASDC shall provide for portable operator interface either through connection to the space sensor or connection directly to the ASDC.
 - e. Programmable ASDC's shall be provided with 72 hour battery back-up or non-volatile EEPROM memory and self-contained clock. The clock shall be capable of time synchronization from the DDC.
2. Unitary Control Interfaces:
- a. Where unitary controls of packaged equipment are capable of communicating with the specified control system, they may be integrated into the network in lieu of Stand-Alone Digital Controllers. All specified functions and monitoring points shall be provided as specified in the Drawings and/or sequence of operations. Where required control and monitoring points are not provided as part of the unitary controls, DDC control and monitoring shall be provided.
- I. On/Off Outputs: The control panel shall internally provide test points for the circuit driving the equipment contactor, for troubleshooting the low voltage circuit to the contactor. All relays or digital output modules shall provide a pilot light or LED display of this same status.
 - J. Modulating Outputs shall be industry standard 0-5 VDC, 0-12 VDC or Milliamp outputs of 0-20 mA or 4-20 mA, or drive open/drive closed type modulating outputs. Drive open/drive closed type controllers shall include sufficient components and control algorithms.
 - K. Generally, the stand-alone digital controller and control panel shall be located on or near the unit, which they control as indicated on the Drawings.
 - L. Lightning arrestors shall be provided on all wiring, which exists or enters the building. Arrestors shall be located adjacent to the protected equipment.
 - M. As a part of this contract the Temperature Control Subcontractor shall provide eight hours of classroom instruction in operation, programming and maintenance of the system to owners operating and maintenance personnel. Instructors shall be fully qualified in all aspects of the system. Training shall be scheduled as required by the owner and shall take place at an owner-designated location. Training shall be video recorded and provided to the Owner in an external storage device (thumb drive or flash drive with USB).

PART 3 EXECUTION

3.01 WORK BY OTHERS

- A. All line voltage wiring (101 volts or more) shall be furnished and installed as a part of Division 26.
- B. All low voltage wiring (100 volts or below) shall be furnished and installed as an integral part of this section of the specification in strict accordance with Division 26. Refer to Division 26 for

special requirements of separation between Control and Instrumentation wiring from Communications/Data Cabling.

- C. All dampers, valves, immersion wells and pipe pressure tapings will be installed by the Mechanical Contractor.
- D. All relays, firestats, sensors, annunciators, alarms, or other electrical devices not indicated to be installed by Division 26, shall be installed under Division 23. Coordinate with Division 26 for locations as necessary.

3.02 GENERAL SEQUENCE REQUIREMENTS

- A. Refer to drawings M4.01 and M4.02 for additional information.

3.03 INTERFACE WITH PACKAGED UNITARY EQUIPMENT CONTROLLERS

- A. Where packaged equipment is indicated elsewhere within the Contract Documents to provide unitary control with BACNET or similar interface, the DDC shall communicate with and monitor the packaged controllers. Coordinate with available equipment protocols, BACNET MS/TP (or BACNET IP if approved by Owner). At a minimum, the DDC system shall:
 - 1. Provide signals to the packaged controllers for occupancy and all setpoints necessary. Setpoints adjustment shall be available through the graphics interface. Occupancy scheduling shall be as indicated for equipment with DDC control.
 - 2. Monitor all unit alarms and provide an alarm within the BAS of any alarm conditions within the unit. Alarm indications shall be specific to the type alarm occurring with the unit.
 - 3. Monitor all points indicated within this section, all points indicated within the respective equipment specifications and all points shown on the controls schematic Drawings. Additional points shall include monitoring of actual unit percent capacity or stages of capacity where available. Where any control or data point is not provided within the equipment controls, the DDC shall provide the necessary input/output, sensor, etc. necessary for control or monitoring of that point.
 - 4. Provide graphics displays for all packaged equipment to include: all points indicated within this section, all points indicated within the respective packaged equipment specifications, and all points shown on the controls schematic Drawings. The main graphics display for the respective unit shall include all points shown on the controls schematic Drawings. Any data available in excess of that indicated above shall be available outside the main graphics screen.

3.04 SYSTEM MONITORING AND ALARM

- A. The DDC shall provide an alarm for the points listed on drawings M4.01 and M4.02 as applicable to each unit, system, or piece of equipment.

3.05 INSTALLATION

- A. The location of all control items on the exterior of the building shall be approved by the Architect prior to installation.
- B. Where the condition occurs, provide insulated sub bases for all space temperature sensors located on exterior walls.

- C. All sensors located in equipment, ductwork and piping shall be installed with appropriate fittings such that devices are securely attached to coils, duct, pipe, or similar and are not free to move, rotate, or become dislodged. The use of adhesives for attachment is not permitted.

3.06 SERVICE AND GUARANTEE

- A. The entire control system shall be serviced and maintained in first class condition by the control manufacturer for a period of one year after acceptance at no extra cost to the Owner.

END OF SECTION

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.03 DEFINITIONS

- A. VFC: Variable frequency controller.

PART 2 PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THW-2, Type THHN-2-THWN-2, and Type XHHW-2.
- C. Multi-conductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.
- D. VFC Cable:
 - 1. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable.
 - 2. Type TC-ER with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil-resistant outer PVC jacket.
 - 3. Comply with UL requirements for cables in Classes I and II, Division 2 hazardous location applications.

2.02 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.03 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire mesh, strain relief device at terminations to suit application.
- G. VFC Output Circuits: Type TC-ER cable with dual tape shield.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

END OF SECTION

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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. Section includes:
 - 1. Conductors.
 - 2. Connectors.

1.03 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.03 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

PART 3 EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

3.02 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

3.03 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

END OF SECTION

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.

1.04 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70.

1.06 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 2. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 EXECUTION

3.01 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

- C. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To New Concrete: Bolt to concrete inserts.
 - 2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 3. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 4. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 5. To Light Steel: Sheet metal screws.
 - 6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 260533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Boxes, enclosures, and cabinets.
 - 5. Handholes and boxes for exterior underground cabling.

1.03 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. IMC: Intermediate metal conduit.

1.04 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. IMC: Comply with ANSI C80.6 and UL 1242.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel or die cast.

- b. Type: Setscrew or compression.
- 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- H. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ENT: Comply with NEMA TC 13 and UL 1653.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. LFNC: Comply with UL 1660.
- E. RTRC: Comply with UL 1684A and NEMA TC 14.
- F. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- G. Fittings for LFNC: Comply with UL 514B.
- H. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Wireway Covers: Hinged type or flanged-and-gasketed type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

2.04 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with

captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

- C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.05 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Metal Floor Boxes:
 - 1. Material: Cast metal or sheet metal.
 - 2. Type: Fully adjustable.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.
- I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep or 4 inches by 2-1/8 inches by 2-1/8 inches deep as required for application.
- K. Gangable boxes are prohibited.
- L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2. Nonmetallic Enclosures: Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.06 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of reinforced concrete or fiberglass as required for application.

1. Standard: Comply with SCTE 77.
2. Color of Frame and Cover: Green.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC."
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or RNC, Type EPC-40-PVC.

2. Concealed Conduit, Aboveground: RNC, Type EPC-40-PVC.
 3. Underground Conduit: Type EPC-40-PVC, concrete encased.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms (lower than 3'-0").
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
- C. Minimum Raceway Size: 3/4-inch trade size. 1-inch for communication and security.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.02 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply

with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from ENT to GRC before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal

bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- V. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - 3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

- W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- AA. Locate boxes so that cover or plate will not span different building finishes.
- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- DD. Set metal floor boxes level and flush with finished floor surface.
- EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.05 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer."

END OF SECTION

SECTION 260544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

- D. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- E. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

2.03 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.04 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 4 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

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. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.03 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.04 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.01 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.02 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
 - 1. Black letters on an orange field.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.03 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

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

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

2.04 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.05 FLOOR MARKING TAPE

- A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.06 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2.07 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.08 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
- H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - a. Color shall be factory applied.
 - b. Colors for 208/110-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:

- 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- C. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- E. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.

- b. Controls with external control power connections.
- G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
- 1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 - 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label. Circuit description must be updated with Final Room Name and Number changes issued during construction.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchboards.
 - e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - f. Enclosed switches.
 - g. Enclosed circuit breakers.
 - h. Enclosed controllers.
 - i. Variable-speed controllers.
 - j. Push-button stations.

- k. Power transfer equipment.
 - l. Contactors.
 - m. Remote-controlled switches, dimmer modules, and control devices.
 - n. Battery-inverter units.
 - o. Power-generating units.
 - p. Monitoring and control equipment.
3. Identify junction boxes above ceilings with hand written circuit identification.

END OF SECTION

SECTION 260923

LIGHTING CONTROL DEVICES

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. Section Includes:
 - 1. Time switches.
 - 2. Photoelectric switches.
 - 3. Indoor occupancy sensors.
 - 4. Lighting contactors.
- B. Related Requirements:
 - 1. Section 262726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 PRODUCTS

2.01 TIME SWITCHES

- A. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
 - 3. Astronomic Time: All channels.
 - 4. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.
- B. Electromechanical-Dial Time Switches: Comply with UL 917.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Circuitry: Allows connection of a photoelectric relay as a substitute for the on-off function of a program.
 - 3. Astronomic time dial.

4. Eight-Day Program: Uniquely programmable for each weekday and holidays.
5. Skip-a-day mode.
6. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.02 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Description: Solid state, with DPST dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
 3. Time Delay: Thirty-second minimum, to prevent false operation.
 4. Lightning Arrester: Air-gap type.
 5. Mounting: Twist lock complying with NEMA C136.10, with base.

2.03 INDOOR OCCUPANCY SENSORS

- A. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 7. Bypass Switch: Override the "on" function in case of sensor failure.

- B. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
 - 1. Sensitivity Adjustment: Separate for each sensing technology.
 - 2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.04 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
 - 3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
 - 4. Dual technology.

2.05 LIGHTING CONTACTORS

- A. Description: Electrically operated and mechanically held, combination-type lighting contactors with fusible switch, complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - 3. Enclosure: Comply with NEMA 250.
 - 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.
- B. Security Interface: Provide hardware interface to enable activation of the security system to turn off the lighting contactors controlling new and existing interior night lights.

2.06 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 EXECUTION

3.01 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.03 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.04 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

END OF SECTION

SECTION 262416

PANELBOARDS

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. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.03 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.

8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing. Coordinate Final Room Names and Numbers with room names and numbers issued during construction.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017700 "Closeout Procedures," include the following:
 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Keys: Two spares for each type of panelboard cabinet lock.
 2. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 3. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.08 QUALITY ASSURANCE

- A. Comply with NEMA PB 1.
- B. Comply with NFPA 70.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.11 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:

1. Square D.
2. Siemens.

2.02 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finishes:
 - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
4. Directory Card: Inside panelboard door, mounted in transparent card holder.

- B. Incoming Mains Location: Top and bottom.

- C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

- D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.

- 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
- 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- 6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- 7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.03 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.04 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1, power and feeder distribution type.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches high, provide two latches, keyed alike.
- C. Mains: Circuit breaker.
- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.05 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker or lugs only.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- E. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.06 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and $I^2 t$ response.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install panelboards and accessories according to NECA 407.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- C. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- I. Comply with NECA 1.

3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.04 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly and lubricate as recommended by manufacturer.

3.05 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.06 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain panelboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION

SECTION 262726

WIRING DEVICES

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. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Isolated-ground receptacles.
 - 3. Tamper-resistant receptacles.
 - 4. Weather-resistant receptacles.
 - 5. Snap switches and wall-box dimmers.
 - 6. Wall-switch and exterior occupancy sensors.
 - 7. Communications outlets.
 - 8. Cord and plug sets.
 - 9. Floor service outlets and poke-through assemblies.

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.06 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.08 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
 2. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.

PART 2 PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 2. Devices shall comply with the requirements in this Section.

2.02 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Pilot-Light Switches, 20 A:
 - 1. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."
- C. Key-Operated Switches, 120/277 V, 20 A:
 - 1. Description: Single pole, with factory-supplied key in lieu of switch handle.
- D. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

2.03 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable toggle switch; with single-pole or three-way switching. Comply with UL 1472.

2.04 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Stainless Steel with head color to match plate finish.
 - 2. Material for Damp Locations: Stainless with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.5 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: All devices shall be gray.
- B. Wall Plate Color: Stainless Steel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- F. Dimmers:
1. Install dimmers within terms of their listing.
 2. Verify that dimmers used for fan speed control are listed for that application.
 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

END OF SECTION

SECTION 262816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Shunt trip switches.
 - 4. Molded-case circuit breakers (MCCBs).
 - 5. Molded-case switches.
 - 6. Enclosures.

1.03 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017700 "Closeout Procedures," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Comply with NFPA 70.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.08 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:

1. Square D.
2. Siemens.

2.02 FUSIBLE SWITCHES

- A. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

2.03 NONFUSIBLE SWITCHES

- A. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

2.04 SHUNT TRIP SWITCHES

- A. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- B. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- D. Accessories:
 1. Oiltight key switch for key-to-test function.
 2. Oiltight red ON pilot light.
 3. Isolated neutral lug; 200 percent rating.
 4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 5. Form C alarm contacts that change state when switch is tripped.
 6. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.05 MOLDED-CASE CIRCUIT BREAKERS

- A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- B. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- C. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I²t response.
- D. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

2.06 MOLDED-CASE SWITCHES

- A. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

2.07 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

2. Outdoor Locations: NEMA 250, Type 3R.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.03 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

SECTION 265119

LED LIGHTING

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. Section Includes:
 - 1. Interior solid-state luminaires that use LED technology.
 - 2. Lighting fixture supports.
- B. Related Requirements:
 - 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include emergency lighting units, including batteries and chargers.
 - 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.05 INFORMATIONAL SUBMITTALS

- A. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
 2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.08 QUALITY ASSURANCE

- A. Provide luminaires from a single manufacturer for each luminaire type.
- B. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.01 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. Recessed Fixtures: Comply with NEMA LE 4.
- D. Bulb shape complying with ANSI C79.1.
- E. Lamp base complying with ANSI C81.61.
- F. CRI of 80. CCT of 4100 K.
- G. Rated lamp life of 50,000 hours.
- H. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- I. Internal driver.
- J. Nominal Operating Voltage: 277 V ac.
 - 1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

2.02 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI for all luminaires.

2.03 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to a minimum 20 gauge backing plate attached to wall structural members.
 - 2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch-diameter aircraft cable supports adjustable to length indicated on drawings.
 2. Ceiling mount with pendant mount with 5/32-inch-diameter aircraft cable supports adjustable in length.
 3. Ceiling mount with hook mount.
- H. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- I. Ceiling-Grid-Mounted Luminaires:
1. Secure to any required outlet box.
 2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of two locations, spaced near corners of luminaire.
- J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.03 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

- A. Luminaire will be considered defective if it does not pass operation tests and inspections.

END OF SECTION

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Boxes, enclosures, and cabinets.

1.2 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale and coordinated with each other, using input from installers of items involved.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.
- B. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
 - 2. Comply with TIA-569-D.
- C. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

2.2 BOXES, ENCLOSURES, AND CABINETS

- A. Description: Enclosures for communications.
- B. General Requirements for Boxes, Enclosures, and Cabinets:
 - 1. Comply with TIA-569-D.
 - 2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
 - 3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

- A. Minimum Pathway Size: 3/4-inch trade size for copper and aluminum cables, and 1 inch for optical-fiber cables.
- B. Pathway Fittings: Compatible with pathways and suitable for use and location.
- C. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

3.2 INSTALLATION

- A. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Complete pathway installation before starting conductor installation.
- C. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- D. Support conduit within 12 inches of enclosures to which attached.
- E. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- F. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

- G. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
 - H. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
 - I. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
 - J. Surface Pathways:
 - 1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
 - 2. Install surface pathway with a minimum 2-inch radius control at bend points.
 - 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
 - K. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
 - 1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
 - 2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
 - L. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.
 - M. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
 - N. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
 - O. Mount boxes at heights indicated on Drawings.
 - P. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.
 - Q. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
 - R. Set metal floor boxes level and flush with finished floor surface.
 - S. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- 3.3 PROTECTION
- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
- END OF SECTION 270528



Solutions for all your Environmental and OSHA Concerns

December 22, 2021

Asbestos & Lead Inspection Report

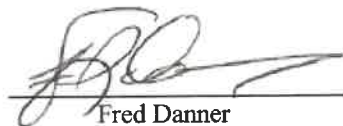
Project Location:

5305 Hollins Road
Roanoke, Virginia

Prepared For:

Roanoke County General Services
Roanoke, VA

Prepared By:


Fred Danner
Interim Lead Inspector

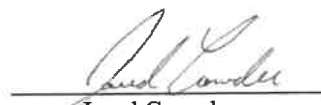

Jared Crowder
Asbestos Inspector

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Scope of Work

HDH Technical, Inc. was contracted by Roanoke County to provide an asbestos inspection and lead-based paint screening of the structure located at 5305 Hollins Road, Roanoke, Virginia. The inspection was conducted by personnel trained and licensed in accordance with the regulations of the Environmental Protection Agency (EPA) and the Commonwealth of Virginia. This inspection was performed using current EPA AHERA standards. This protocol was used for the determination, sampling and analysis of suspected Asbestos Containing Materials (ACM). Only those parts of the structure scheduled to undergo renovation, as directed by the client, were included in this inspection.

Also included in this report is a Lead-Based Paint Screening at this location. The term “screening” is used as opposed to “inspection” due to the fact that a complete HUD type paint inspection of each surface in every space was not performed. Generally speaking, each differing type of interior and exterior component and each differing type of paint was tested, although each component was not tested in each room. This “screening” will be referred to as an “inspection” throughout this report and was conducted in accordance with accepted industry standards and applicable regulations established by OSHA and the EPA. This inspection only identifies lead-based paint that is accessible through non-destructive methods. It does not identify lead-based paint materials located within walls, concrete decks, subfloors, or other generally inaccessible areas.

ASBESTOS INSPECTION

An inspection of 5305 Hollins Road was performed on December 16, 2021 by representatives of HDHT. The objective of this inspection was to determine the location of asbestos-containing building materials (ACBM) currently located on the interior of this structure that may be disturbed in conjunction with upcoming renovation activities at this structure.

The inspection was conducted by personnel trained and licensed in accordance with the regulations of the Environmental Protection Agency (EPA) and the Commonwealth of Virginia. This inspection meets the protocol outlined in current EPA AHERA regulations. This protocol was used for the determination, sampling and analysis of suspect asbestos containing materials.

As the sample summary indicates, the following suspect materials sampled were reported to be asbestos containing by the laboratory:

- **All Floor Tile and Associated Mastic in Office Area – *Excluding* Gray Floor Tile at Customer Entrance and Black Floor Tile in Storage Room**
- **Window and Door Framing Caulk – *Excluding* South Entrance**

These NON-Friable asbestos containing materials should be removed prior to renovation activities at this location, if they are to be disturbed. Removal should be performed by licensed, contract personnel using approved methods.

Friable Asbestos Material: Material when dry, may be crumbled, pulverized or reduced to powder by hand pressure and includes previously non-friable material after such previously non-friable material becomes damaged to the extent that when dry may be crumbled, pulverized, or reduced to powder by hand pressure.

Non-friable Asbestos Material: Material that contains asbestos in which the fibers have been locked in by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not release fibers during any appropriate use, handling, demolition, storage, transportation, processing or disposal.

ASBESTOS LESS THAN 1%

For informational purposes, the following suspect material was reported to contain asbestos at < 1%. Although not considered an Asbestos Containing Material (> 1%), this information should be provided to all contract personnel prior to restoration/demolition activities for their use in meeting current OSHA requirements pertaining to personnel disturbing this material:

- **Door Framing Caulk – South Entrance**

This information should be provided to all contract personnel for their use in meeting current OSHA requirements. Every attempt was made to gain access to all areas or to assess representative materials entering or leaving the area. HDH Technical, Inc. accepts no liability nor makes any claims regarding ACBM which was not accessible during the inspection process if such material was located behind or within walls, concrete decks, subfloors, or was generally inaccessible without destructive sampling. If any additional suspect materials are identified during the course of the project, the contractor is to immediately stop work and contact the Owner for further direction.

Asbestos Sample Summary

5305 Hollins Road

LAB #	SAMPLE ID	SAMPLE DESCRIPTION	RESULT	%
21077363 -001	FT 1.1	Floor Tile - 12x12 - Brown - Entry/Closet	■	2%
21077363 -002	FT 1.2	Floor Tile - 12x12 - Brown - Entry/Closet	■	2%
21077363 -003	TM 2.1	Tile Mastic - FT 1	■	2%
21077363 -004	TM 2.2	Tile Mastic - FT 1	■	2%
21077363 -005	SR 3.1	Sheetrock	ND	-
21077363 -006	SR 3.2	Sheetrock	ND	-
21077363 -007	SR 3.3	Sheetrock	ND	-
21077363 -008	SR 3.4	Sheetrock	ND	-
21077363 -009	SR 3.5	Sheetrock	ND	-
21077363 -010	JC 4.1	Joint Compound	ND	-
21077363 -011	JC 4.2	Joint Compound	ND	-
21077363 -012	JC 4.3	Joint Compound	ND	-
21077363 -013	JC 4.4	Joint Compound	ND	-
21077363 -014	JC 4.5	Joint Compound	ND	-
21077363 -015	FT 5.1	Floor Tile - 12x12 - White/Gray - Break Room	■	3%
21077363 -016	FT 5.2	Floor Tile - 12x12 - White/Gray - Break Room	■	3%
21077363 -017	TM 6.1	Tile Mastic - FT 5	■	3%
21077363 -018	TM 6.2	Tile Mastic - FT 5	■	3%
21077363 -019	FT 7.1	Floor Tile - 12x12 - White/Tan - Office	■	2%
21077363 -020	FT 7.2	Floor Tile - 12x12 - White/Tan - Office	■	2%
21077363 -021	TM 8.1	Tile Mastic - FT 7	■	3%
21077363 -022	TM 8.2	Tile Mastic - FT 7	■	3%
21077363 -023	FT 9.1	Floor Tile - 12x12 - White/Black Pitted	■	4%
21077363 -024	FT 9.2	Floor Tile - 12x12 - White/Black Pitted	■	4%
21077363 -025	TM 10.1	Tile Mastic - FT 9	■	5%
21077363 -026	TM 10.2	Tile Mastic - FT 9	■	5%
21077363 -027	FT 11.1	Floor Tile - 12x12 - Tan - Closet	■	2%
21077363 -028	FT 11.2	Floor Tile - 12x12 - Tan - Closet	■	2%
21077363 -029	TM 12.1	Tile Mastic - FT 11	■	3%
21077363 -030	TM 12.2	Tile Mastic - FT 11	■	3%
21077363 -031	FT 13.1	Floor Tile - 12x12 - White/Gray - Customer Entrance	ND	-
21077363 -032	FT 13.2	Floor Tile - 12x12 - White/Gray - Customer Entrance	ND	-

ND = NONE DETECTED

NA = NOT ANALYZED
POSITIVE STOP

■ = CHRYSOTILE

▲ = AMOSITE

⊙ = OTHER

5305 Hollins Road

LAB #	SAMPLE ID	SAMPLE DESCRIPTION	RESULT	%
21077363 -033	BM 14.1	Baseboard Masic - Gray/Brown	ND	-
21077363 -034	BM 14.2	Baseboard Masic - Gray/Brown	ND	-
21077363 -035	BM 15.1	Baseboard Masic - Dark Brown	ND	-
21077363 -036	BM 15.2	Baseboard Masic - Dark Brown	ND	-
21077363 -037	CT 16.1	Ceiling Tile - 2x4 Fiberglass - Facer	ND	-
21077363 -038	CT 16.2	Ceiling Tile - 2x4 Fiberglass - Facer	ND	-
21077363 -039	CT 16.3	Ceiling Tile - 2x4 Fiberglass - Facer	ND	-
21077363 -040	CT 17.1	Ceiling Tile - 2x4 ACT	ND	-
21077363 -041	CT 17.2	Ceiling Tile - 2x4 ACT	ND	-
21077363 -042	CT 17.3	Ceiling Tile - 2x4 ACT	ND	-
21077363 -043	TW 18.1	Textured Wall - Purple Room	ND	-
21077363 -044	TW 18.2	Textured Wall - Purple Room	ND	-
21077363 -045	FT 19.1	Floor Tile - 12x12 - Gray/Green - Closet	■	2%
21077363 -046	FT 19.2	Floor Tile - 12x12 - Gray/Green - Closet	■	2%
21077363 -047	TM 20.1	Tile Mastic - FT 19	■	3%
21077363 -048	TM 20.2	Tile Mastic - FT 19	■	3%
21077363 -049	FT 21.1	Floor Tile - 12x12 - Black - Restroom	ND	-
21077363 -050	FT 21.2	Floor Tile - 12x12 - Black - Restroom	ND	-
21077363 -051	TM 22.1	Tile Mastic - FT 21	ND	-
21077363 -052	TM 22.2	Tile Mastic - FT 21	ND	-
21077363 -053	FT 23.1	Floor Tile - 12x12 - Under FT 21	■	5%
21077363 -054	FT 23.2	Floor Tile - 12x12 - Under FT 21	■	5%
21077363 -055	TM 24.1	Tile Mastic - FT 23	■	5%
21077363 -056	TM 24.2	Tile Mastic - FT 23	■	5%
21077363 -057	FT 25.1	Floor Tile - 12x12 - Black/White	ND	-
21077363 -058	FT 25.2	Floor Tile - 12x12 - Black/White	ND	-
21077363 -059	WF 26.1	Window/Door Framing - Front	■	10%
21077363 -060	WF 26.2	Window/Door Framing - Front	■	10%
21077363 -061	DF 27.1	Door Framing - South Entrance	■	<1%
21077363 -062	DF 27.2	Door Framing - South Entrance	■	<1%
21077363 -063	ES 28.1	Exterior Surfacing	ND	-
21077363 -064	ES 28.2	Exterior Surfacing	ND	-

ND = NONE DETECTED

NA = NOT ANALYZED
POSITIVE STOP

■ = CHRYSOTILE

▲ = AMOSITE

⊙ = OTHER

5305 Hollins Road

[illegible]

ND = NONE DETECTED

NA = NOT ANALYZED
POSITIVE STOP

■ = CHRYSOTILE

▲ = AMOSITE

○ = OTHER

Laboratory Report



10501 Trade Ct., Suite 100
N. Chesterfield, VA 23139
804-897-1177 / 888-895-1175
Fax 804-897-0070
www.sanair.com

**Asbestos
Chain of Custody**

SanAir ID Number 21077363

Company: HDH Technical, Inc		Project #: Roanoke County	Collected by: Crowder
Address: 1305 Radford Street		Project Name: 5305 Hollins Rd Roanoke	Phone #: 540-381-7999
City, St, Zip: Christiansburg, VA 24073		Date Collected: 12/16/2021	Email: rtiebal@hdhassociates.com
State of Collection: VA Account #: 1769		P.O. Number:	Email: jcrowder@hdhassociates.com

Bulk		Air		Soil/Vermiculite	
ABB	PLM EPA 600/R-93/116 <input checked="" type="checkbox"/>	ABA	PCM NIOSH 7400 <input type="checkbox"/>	ABSE	PLM EPA 600/R-93/116 (Qual.) <input type="checkbox"/>
	Positive Stop <input type="checkbox"/>	ABA-2	OSHA w/ TWA* <input type="checkbox"/>	ABSP	PLM CARB 435 (LOD <1%) <input type="checkbox"/>
ABEPA	PLM EPA 400 Point Count <input type="checkbox"/>	ABTEM	TEM AHERA <input type="checkbox"/>	ABSP1	PLM CARB 435 (LOD 0.25%) <input type="checkbox"/>
ABB1K	PLM EPA 1000 Point Count <input type="checkbox"/>	ABATN	TEM NIOSH 7402 <input type="checkbox"/>	ABSP2	PLM CARB 435 (LOD 0.1%) <input type="checkbox"/>
ABBEN	PLM EPA NOB <input type="checkbox"/>	ABT2	TEM Level II <input type="checkbox"/>		
ABBCH	TEM Chatfield <input type="checkbox"/>				
ABBTM	TEM EPA NOB <input type="checkbox"/>				
Water		New York ELAP		Dust	
ABHE	EPA 100.2 <input type="checkbox"/>	PLM NY	PLM EPA 600/M4-82-020 <input type="checkbox"/>	ABWA	TEM Wipe ASTM D-6480 <input type="checkbox"/>
		ABEPA2	NY ELAP 198.1 <input type="checkbox"/>	ABDMV	TEM Microvac ASTM D-5755 <input type="checkbox"/>
		ABENY	NY ELAP 198.6 PLM NOB <input type="checkbox"/>		
		ABBNY	NY ELAP 198.4 TEM NOB <input type="checkbox"/>	Matrix	Other <input type="checkbox"/>

Turn Around Times	3 HR (4 HR TEM) <input type="checkbox"/>	6 HR (8HR TEM) <input type="checkbox"/>	12 HR <input type="checkbox"/>	24 HR <input checked="" type="checkbox"/>
	2 Days <input type="checkbox"/>	3 Days <input type="checkbox"/>	4 Days <input type="checkbox"/>	5 Days <input type="checkbox"/>

Special Instructions:	
-----------------------	--

SAMPLE ID	SAMPLE DESCRIPTION
FT 1.1	Floor Tile - 12x12 - Brown - Entry/Closet
FT 1.2	Floor Tile - 12x12 - Brown - Entry/Closet
TM 2.1	Tile Mastic - FT 1
TM 2.2	Tile Mastic - FT 1
SR 3.1	Sheetrock
SR 3.2	Sheetrock
SR 3.3	Sheetrock
SR 3.4	Sheetrock
SR 3.5	Sheetrock
JC 4.1	Joint Compound
JC 4.2	Joint Compound

Special Instructions	
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Relinquished by	Date	Time	Received by	Date	Time
Crowder	12/16/2021	3:00 PM	UPS	12/16/2021	3:00 PM
			<i>SAH</i>	12/17/21	1005am

Unless scheduled, the turn around time for all samples received after 3 pm EST Friday will begin at 8 am Monday morning. Weekend or Holiday work must be scheduled ahead of time and is charged for rush turn around time. Work with standard turn around time sent Priority Overnight and Billed to Recipient will be charged a \$10 shipping fee.

21077363

SAMPLE ID	SAMPLE DESCRIPTION
JC 4.3	Joint Compound
JC 4.4	Joint Compound
JC 4.5	Joint Compound
FT 5.1	Floor Tile - 12x12 - White/Gray - Break Room
FT 5.2	Floor Tile - 12x12 - White/Gray - Break Room
TM 6.1	Tile Mastic - FT 5
TM 6.2	Tile Mastic - FT 5
FT 7.1	Floor Tile - 12x12 - White/Tan - Office
FT 7.2	Floor Tile - 12x12 - White/Tan - Office
TM 8.1	Tile Mastic - FT 7
TM 8.2	Tile Mastic - FT 7
FT 9.1	Floor Tile - 12x12 - White/Black Pitted
FT 9.2	Floor Tile - 12x12 - White/Black Pitted
TM 10.1	Tile Mastic - FT 9
TM 10.2	Tile Mastic - FT 9
FT 11.1	Floor Tile - 12x12 - Tan - Closet
FT 11.2	Floor Tile - 12x12 - Tan - Closet
TM 12.1	Tile Mastic - FT 11
TM 12.2	Tile Mastic - FT 11
FT 13.1	Floor Tile - 12x12 - White/Gray - Customer Entrance
FT 13.2	Floor Tile - 12x12 - White/Gray - Customer Entrance
BM 14.1	Baseboard Masic - Gray/Brown
BM 14.2	Baseboard Masic - Gray/Brown
BM 15.1	Baseboard Masic - Dark Brown
BM 15.2	Baseboard Masic - Dark Brown
CT 16.1	Celling Tile - 2x4 Fiberglass - Facer
CT 16.2	Celling Tile - 2x4 Fiberglass - Facer

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Relinquished by	Date	Time	Received by	Date	Time
Crowder	12/16/2021	3:00 PM	Ups S.H.	12/16/2021	3:00 PM
				12/17/21	10:00 am

Unless scheduled, the turn around time for all samples received after 3 pm EST Friday will begin at 8 am Monday morning. Weekend or Holiday work must be scheduled ahead of time and is charged for rush turn around time. Work with standard turn around time sent Priority Overnight and Billed to Recipient will be charged a \$10 shipping fee.

21077363

SAMPLE ID	SAMPLE DESCRIPTION
CT 16.3	Ceiling Tile - 2x4 Fiberglass - Facer
CT 17.1	Ceiling Tile - 2x4 ACT
CT 17.2	Ceiling Tile - 2x4 ACT
CT 17.3	Ceiling Tile - 2x4 ACT
TW 18.1	Textured Wall - Purple Room
TW 18.2	Textured Wall - Purple Room
FT 19.1	Floor Tile - 12x12 - Gray/Green - Closet
FT 19.2	Floor Tile - 12x12 - Gray/Green - Closet
TM 20.1	Tile Mastic - FT 19
TM 20.2	Tile Mastic - FT 19
FT 21.1	Floor Tile - 12x12 - Black - Restroom
FT 21.2	Floor Tile - 12x12 - Black - Restroom
TM 22.1	Tile Mastic - FT 21
TM 22.2	Tile Mastic - FT 21
FT 23.1	Floor Tile - 12x12 - Under FT 21
FT 23.2	Floor Tile - 12x12 - Under FT 21
TM 24.1	Tile Mastic - FT 23
TM 24.2	Tile Mastic - FT 23
FT 25.1	Floor Tile - 12x12 - Black/White
FT 25.2	Floor Tile - 12x12 - Black/White
WF 26.1	Window/Door Framing - Front
WF 26.2	Window/Door Framing - Front
DF 27.1	Door Framing - South Entrance
DF 27.2	Door Framing - South Entrance
ES 28.1	Exterior Surfacing
ES 28.2	Exterior Surfacing
ES 28.3	Exterior Surfacing

Special Instructions	
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Relinquished by	Date	Time	Received by	Date	Time
Crowder	12/16/2021	3:00 PM	UPS SALY	12/16/2021 12/17/21	3:00 PM 1005am

Unless scheduled, the turn around time for all samples received after 3 pm EST Friday will begin at 8 am Monday morning. Weekend or Holiday work must be scheduled ahead of time and is charged for rush turn around time. Work with standard turn around time sent Priority Overnight and Billed to Recipient will be charged a \$10 shipping fee.

[illegible]

Special Instructions	
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Relinquished by	Date	Time	Received by	Date	Time
Crowder	12/16/2021	3:00 PM	UPS	12/16/2021	3:00 PM
			<i>[Signature]</i>	12/17/21	10:5am

Unless scheduled, the turn around time for all samples received after 3 pm EST Friday will begin at 8 am Monday morning. Weekend or Holiday work must be scheduled ahead of time and is charged for rush turn around time. Work with standard turn around time sent Priority Overnight and Billed to Recipient will be charged a \$10 shipping fee.



SanAir ID Number
21077363
FINAL REPORT
12/20/2021 4:59:06 PM

Name: HDH Technical, Inc.
Address: P.O. Box 6158
Christiansburg, VA 24073
Phone: 540-381-7999

Project Number: Roanoke County
P.O. Number:
Project Name: 5305 Hollins Rd Roanoke
Collected Date: 12/16/2021
Received Date: 12/17/2021 10:05:00 AM

Analyst: Hogrefe, Sarah | Vaughan, Nathaniel

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic	Components		Asbestos Fibers
	Appearance	% Fibrous	% Non-fibrous	
FT 1.1 / 21077363-001 Floor Tile - 12x12 - Entry / Closet	Brown Non-Fibrous Homogeneous		98% Other	2% Chrysotile
FT 1.2 / 21077363-002 Floor Tile - 12x12 - Entry / Closet	Brown Non-Fibrous Homogeneous		98% Other	2% Chrysotile
TM 2.1 / 21077363-003 Tile Mastic - FT 1	Black Non-Fibrous Homogeneous		98% Other	2% Chrysotile
TM 2.2 / 21077363-004 Tile Mastic - FT 1	Black Non-Fibrous Homogeneous		98% Other	2% Chrysotile
SR 3.1 / 21077363-005 Sheetrock	Gray Non-Fibrous Homogeneous	5% Cellulose	95% Other	None Detected
SR 3.2 / 21077363-006 Sheetrock	Gray Non-Fibrous Homogeneous	5% Cellulose	95% Other	None Detected
SR 3.3 / 21077363-007 Sheetrock	Gray Non-Fibrous Homogeneous	5% Cellulose	95% Other	None Detected
SR 3.4 / 21077363-008 Sheetrock	Gray Non-Fibrous Homogeneous	5% Cellulose	95% Other	None Detected
SR 3.5 / 21077363-009 Sheetrock	Gray Non-Fibrous Homogeneous	5% Cellulose	95% Other	None Detected
JC 4.1 / 21077363-010 Joint Compound	White Non-Fibrous Homogeneous		100% Other	None Detected

Analyst:

Approved Signatory:

Analysis Date: 12/20/2021

Date: 12/20/2021



SanAir ID Number
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Name: HDH Technical, Inc.
Address: P.O. Box 6158
Christiansburg, VA 24073
Phone: 540-381-7999

Project Number: Roanoke County
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Received Date: 12/17/2021 10:05:00 AM

Analyst: Hogrefe, Sarah | Vaughan, Nathaniel

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic	Components		Asbestos Fibers
	Appearance	% Fibrous	% Non-fibrous	
JC 4.2 / 21077363-011 Joint Compound	White Non-Fibrous Homogeneous		100% Other	None Detected
JC 4.3 / 21077363-012 Joint Compound	White Non-Fibrous Homogeneous		100% Other	None Detected
JC 4.4 / 21077363-013 Joint Compound	White Non-Fibrous Homogeneous		100% Other	None Detected
JC 4.5 / 21077363-014 Joint Compound	White Non-Fibrous Homogeneous		100% Other	None Detected
FT 5.1 / 21077363-015 Floor Tile 12x12 - Break Room	Gray Non-Fibrous Homogeneous		97% Other	3% Chrysotile
FT 5.2 / 21077363-016 Floor Tile 12x12 - Break Room	Gray Non-Fibrous Homogeneous		97% Other	3% Chrysotile
TM 6.1 / 21077363-017 Tile Mastic - FT 5	Black Non-Fibrous Homogeneous		97% Other	3% Chrysotile
TM 6.2 / 21077363-018 Tile Mastic - FT 5	Black Non-Fibrous Homogeneous		97% Other	3% Chrysotile
FT 7.1 / 21077363-019 Floor Tile - 12x12 - Office	White Non-Fibrous Homogeneous		98% Other	2% Chrysotile
FT 7.2 / 21077363-020 Floor Tile - 12x12 - Office	White Non-Fibrous Homogeneous		98% Other	2% Chrysotile

Analyst:

Approved Signatory:

Analysis Date: 12/20/2021

Date: 12/20/2021



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Analyst: Hogrefe, Sarah | Vaughan, Nathaniel

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic	Components		Asbestos Fibers
	Appearance	% Fibrous	% Non-fibrous	
TM 8.1 / 21077363-021 Tile Mastic - FT 7	Black Non-Fibrous Homogeneous		97% Other	3% Chrysotile
TM 8.2 / 21077363-022 Tile Mastic - FT 7	Black Non-Fibrous Homogeneous		97% Other	3% Chrysotile
FT 9.1 / 21077363-023 Floor Tile - 12x12	White Non-Fibrous Homogeneous		96% Other	4% Chrysotile
FT 9.2 / 21077363-024 Floor Tile - 12x12	White Non-Fibrous Homogeneous		96% Other	4% Chrysotile
TM 10.1 / 21077363-025 Tile Mastic - FT 9	Black Non-Fibrous Homogeneous		95% Other	5% Chrysotile
TM 10.2 / 21077363-026 Tile Mastic - FT 9	Black Non-Fibrous Homogeneous		95% Other	5% Chrysotile
FT 11.1 / 21077363-027 Floor Tile - 12x12 - Closet	Tan Non-Fibrous Homogeneous		98% Other	2% Chrysotile
FT 11.2 / 21077363-028 Floor Tile - 12x12 - Closet	Tan Non-Fibrous Homogeneous		98% Other	2% Chrysotile
TM 12.1 / 21077363-029 Tile Mastic - FT 11	Black Non-Fibrous Homogeneous		97% Other	3% Chrysotile
TM 12.2 / 21077363-030 Tile Mastic - FT 11	Black Non-Fibrous Homogeneous		97% Other	3% Chrysotile

Analyst:

Approved Signatory:

Analysis Date: 12/20/2021

Date: 12/20/2021



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Analyst: Hogrefe, Sarah | Vaughan, Nathaniel

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic	Components		Asbestos Fibers
	Appearance	% Fibrous	% Non-fibrous	
FT 13.1 / 21077363-031 Floor Tile - 12x12 - Customer Entrance	Gray Non-Fibrous Homogeneous		100% Other	None Detected
FT 13.2 / 21077363-032 Floor Tile - 12x12 - Customer Entrance	Gray Non-Fibrous Homogeneous		100% Other	None Detected
BM 14.1 / 21077363-033 Baseboard Mastic	Gray Non-Fibrous Homogeneous		100% Other	None Detected
BM 14.2 / 21077363-034 Baseboard Mastic	Gray Non-Fibrous Homogeneous		100% Other	None Detected
BM 15.1 / 21077363-035 Baseboard Mastic	Brown Non-Fibrous Homogeneous		100% Other	None Detected
BM 15.2 / 21077363-036 Baseboard Mastic	Brown Non-Fibrous Homogeneous		100% Other	None Detected
CT 16.1 / 21077363-037 Ceiling Tile - 2x4 Fiberglass - Facer	White Fibrous Homogeneous	95% Glass	5% Other	None Detected
CT 16.2 / 21077363-038 Ceiling Tile - 2x4 Fiberglass - Facer	White Fibrous Homogeneous	95% Glass	5% Other	None Detected
CT 16.3 / 21077363-039 Ceiling Tile - 2x4 Fiberglass - Facer	White Fibrous Homogeneous	95% Glass	5% Other	None Detected
CT 17.1 / 21077363-040 Ceiling Tile - 2x4 ACT	White Fibrous Homogeneous	50% Cellulose 20% Glass	30% Other	None Detected

Analyst:

Approved Signatory:

Analysis Date: 12/20/2021

Date: 12/20/2021



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Analyst: Hogrefe, Sarah | Vaughan, Nathaniel

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic	Components		Asbestos Fibers
	Appearance	% Fibrous	% Non-fibrous	
CT 17.2 / 21077363-041 Ceiling Tile - 2x4 ACT	White Fibrous Homogeneous	50% Cellulose 20% Glass	30% Other	None Detected
CT 17.3 / 21077363-042 Ceiling Tile - 2x4 ACT	White Fibrous Homogeneous	50% Cellulose 20% Glass	30% Other	None Detected
TW 18.1 / 21077363-043 Textured Wall - Room	White Non-Fibrous Homogeneous		100% Other	None Detected
TW 18.2 / 21077363-044 Textured Wall - Room	White Non-Fibrous Homogeneous		100% Other	None Detected
FT 19.1 / 21077363-045 Floor Tile - 12x12 - Closet	Green Non-Fibrous Homogeneous		98% Other	2% Chrysotile
FT 19.2 / 21077363-046 Floor Tile - 12x12 - Closet	Green Non-Fibrous Homogeneous		98% Other	2% Chrysotile
TM 20.1 / 21077363-047 Tile Mastic - FT 19	Black Non-Fibrous Homogeneous		97% Other	3% Chrysotile
TM 20.2 / 21077363-048 Tile Mastic - FT 19	Black Non-Fibrous Homogeneous		97% Other	3% Chrysotile
FT 21.1 / 21077363-049 Floor Tile - 12x12 - Restroom	Black Non-Fibrous Homogeneous		100% Other	None Detected
FT 21.2 / 21077363-050 Floor Tile - 12x12 - Restroom	Black Non-Fibrous Homogeneous		100% Other	None Detected

Analyst:

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Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic	Components		Asbestos Fibers
	Appearance	% Fibrous	% Non-fibrous	
TM 22.1 / 21077363-051 Tile Mastic - FT 21	Tan Non-Fibrous Homogeneous		100% Other	None Detected
TM 22.2 / 21077363-052 Tile Mastic - FT 21	Tan Non-Fibrous Homogeneous		100% Other	None Detected
FT 23.1 / 21077363-053 Floor Tile - 12x12 - Under FT 21	White Non-Fibrous Homogeneous		95% Other	5% Chrysotile
FT 23.2 / 21077363-054 Floor Tile - 12x12 - Under FT 21	White Non-Fibrous Homogeneous		95% Other	5% Chrysotile
TM 24.1 / 21077363-055 Tile Mastic - FT 23	Black Non-Fibrous Homogeneous		95% Other	5% Chrysotile
TM 24.2 / 21077363-056 Tile Mastic - FT 23	Black Non-Fibrous Homogeneous		95% Other	5% Chrysotile
FT 25.1 / 21077363-057 Floor Tile - 12x12	Black Non-Fibrous Homogeneous		100% Other	None Detected
FT 25.2 / 21077363-058 Floor Tile - 12x12	Black Non-Fibrous Homogeneous		100% Other	None Detected
WF 26.1 / 21077363-059 Window / Door Framing - Front	Brown Non-Fibrous Homogeneous		90% Other	10% Chrysotile
WF 26.2 / 21077363-060 Window / Door Framing - Front	Brown Non-Fibrous Homogeneous		90% Other	10% Chrysotile

Analyst:

Approved Signatory:

Analysis Date: 12/20/2021

Date: 12/20/2021



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Analyst: Hogrefe, Sarah | Vaughan, Nathaniel

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic	Components		Asbestos Fibers
	Appearance	% Fibrous	% Non-fibrous	
DF 27.1 / 21077363-061 Door Framing - South Entrance	Tan Non-Fibrous Homogeneous		100% Other	< 1% Chrysotile
DF 27.2 / 21077363-062 Door Framing - South Entrance	Tan Non-Fibrous Homogeneous		100% Other	< 1% Chrysotile
ES 28.1 / 21077363-063 Exterior Surfacing	White Non-Fibrous Heterogeneous		100% Other	None Detected
ES 28.2 / 21077363-064 Exterior Surfacing	White Non-Fibrous Heterogeneous		100% Other	None Detected
ES 28.3 / 21077363-065 Exterior Surfacing	White Non-Fibrous Heterogeneous		100% Other	None Detected
TW 18.3 / 21077363-066 Textured Wall - Room	White Non-Fibrous Homogeneous		100% Other	None Detected

Analyst:

Approved Signatory:

Analysis Date: 12/20/2021

Date: 12/20/2021

Disclaimer

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Samples are held for a period of 60 days. Fibers smaller than 5 microns cannot be seen with this method due to scope limitations.

For NY state samples, method EPA 600/M4-82-020 is performed.

NYELAP Disclaimer:

Polarized- light microscopy is not consistently reliable in detecting asbestos in floor covering and similar non-friable organically bound materials. Quantitative transmission electron microscopy is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos containing.

Asbestos Certifications

NVLAP lab code 200870-0

City of Philadelphia: ALL-460

PA Department of Environmental Protection Number: 68-05397

California License Number: 2915

Colorado License Number: AL-23143

Connecticut License Number: PH-0105

Massachusetts License Number: AA000222

Maine License Number: LB-0075, LA-0084

New York ELAP lab ID: 11983

Rhode Island License Number: PCM00126, PLM00126, TEM00126

Texas Department of State Health Services License Number: 300440

Commonwealth of Virginia 3333000323

Washington State License Number: C989

West Virginia License Number: LT000616

Vermont License: AL166318

Louisiana Department of Environmental Quality: 212253, Cert 05088

Revision Date: 8/14/2020



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Project Number: Roanoke County
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Project Name: 5305 Hollins Rd Roanoke
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Received Date: 12/17/2021 10:05:00 AM

Dear Crowder,

We at SanAir would like to thank you for the work you recently submitted. The 66 sample(s) were received on Friday, December 17, 2021 via UPS. The final report(s) is enclosed for the following sample(s): FT 1.1, FT 1.2, TM 2.1, TM 2.2, SR 3.1, SR 3.2, SR 3.3, SR 3.4, SR 3.5, JC 4.1, JC 4.2, JC 4.3, JC 4.4, JC 4.5, FT 5.1, FT 5.2, TM 6.1, TM 6.2, FT 7.1, FT 7.2, TM 8.1, TM 8.2, FT 9.1, FT 9.2, TM 10.1, TM 10.2, FT 11.1, FT 11.2, TM 12.1, TM 12.2, FT 13.1, FT 13.2, BM 14.1, BM 14.2, BM 15.1, BM 15.2, CT 16.1, CT 16.2, CT 16.3, CT 17.1, CT 17.2, CT 17.3, TW 18.1, TW 18.2, FT 19.1, FT 19.2, TM 20.1, TM 20.2, FT 21.1, FT 21.2, TM 22.1, TM 22.2, FT 23.1, FT 23.2, TM 24.1, TM 24.2, FT 25.1, FT 25.2, WF 26.1, WF 26.2, DF 27.1, DF 27.2, ES 28.1, ES 28.2, ES 28.3, TW 18.3.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

A handwritten signature in black ink that reads "Sandra Sobrino". The signature is fluid and cursive, with the first name "Sandra" being more prominent than the last name "Sobrino".

Sandra Sobrino
Asbestos & Materials Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:

- Cover Letter
- Analysis Pages
- Disclaimers and Additional Information

Sample conditions:

- 66 samples in Good condition.

LEAD INSPECTION

On December 16, 2021 a Lead-Based Paint inspection was also conducted at 5305 Hollins Road. The inspection was conducted to identify potential lead-based paint concerns involved in this renovation project. The areas were inspected by Fred Danner.

The inspection determined that NONE of the surfaces tested contain lead greater than or equal to 1.0 mg/cm, and are NOT considered to be lead-based paint surfaces as defined by the Virginia Department of Professional and Occupational Regulation (DPOR) and the Environmental Protection Agency (EPA).

For informational purposes, the following material was sampled and identified to be a lead component. Although not included in the Virginia Lead-based Paint Activities Regulations, the contractor should be provided this information in the event it is removed for disposal purposes:

- **Painted Steel Sinks**

If lead is present, regardless of quantity, OSHA regulations are applicable. All persons involved in the disturbance of lead based or lead containing painted surfaces should be adequately trained to do so. All contractors should be provided with the results for their use in meeting current OSHA requirements for the protection of their workers and the environment.

This inspection was in compliance with the Virginia Lead-based Paint Activities Regulations, October 1, 1995. The Inspector is properly trained, licensed, and met the competency requirements spelled out in those regulations.

FIELD VERIFICATION

Fred Danner, interim licensed lead-based paint inspector, under the direction of Robin H. Liebal, inspected the structure on December 6, 2021.

A total of Seventy-Five (75) X-Ray Florescence (XRF) readings, including calibrations, were taken in substantial conformance with industry standards and other applicable federal and state regulations.

Robin H. Liebal's Virginia Lead Risk Assessor license number is 3356000422.

A complete copy of all tested surfaces and results are included in this report. All positive samples are listed in BOLD.

HDH Technical, Inc. (HDHT) used the Heuresis Corporation model Pb200i (Serial#1609) X-Ray Fluorescence (XRF) instrument for the screening. This unit was resourced in February 2020. The instrument is not substrate dependent according to that performance characteristic sheet, so no substrate corrections were required during this screening.

The XRF was calibrated prior to use and at the end of the testing, or every four hours, whichever came first. All calibrations were conducted on a 1.10 ± 0.1 mg/cm² NIST SRM paint film. All calibrations are noted on the x-ray fluorescence data sheets.

For the purposes of this inspection lead-based paint is defined as greater than or equal to 1.0 mg/cm². The Heuresis Corporation instrument (model Pb200i) used in this survey have published threshold values of 1.0 mg/cm² on all substrates and do not require substrate correction. Paint chip confirmation of inconclusive samples was not necessary since no inconclusive surfaces were identified during sampling with this X-ray Fluorescence Analyzer. Lastly, this report detailing the findings of the inspection report was written to document the inspection and provide a permanent record of the evaluation.

Qualifications

The inspection was conducted by Fred Danner, interim lead inspector, under the direction of Robin H. Liebal, Licensed Lead Risk Assessor #3356000422. The inspection was conducted in accordance with applicable Local, State, and Federal regulations.

Methodologies

This inspection was conducted in accordance with accepted industry standards and applicable regulations established by OSHA and the EPA. This inspection only identifies lead-based paint that is accessible through non-destructive methods. It does not identify lead-based paint materials located within walls, concrete decks, subfloors, or other generally inaccessible areas.

Disclaimer

This inspection report is written for and intended for the use of the Owner and its representatives only. HDHT is not responsible nor will be held liable for any interpretation made, opinions formed, or conclusions drawn by any third party as a result of examining the lab results, inspection results or this report. Any interpretations, opinions, and conclusions will be those made, formed, and drawn solely by that third party.

A lead inspector/risk assessor properly trained by a training institution utilizing an approved HUD curriculum and subsequently licensed to perform inspections by the Commonwealth of Virginia performed the inspection of this structure. HDHT accepts no liability nor makes any claims regarding lead based painted surfaces which were not tested and lead -based painted surfaces which were not accessible during the inspection process if such material was located behind or within walls, concrete decks, sub-floors, chases, or was otherwise generally inaccessible without destructive sampling.

Lead Based Paint Testing Results



400 West Main Street
Christiansburg, Virginia 24073
Telephone: (540) 381-7999

Lead Testing for Construction

Roanoke County General Services
Roanoke, VA

5305 Hollins Road
Roanoke, VA 24019

READING	CONCENTRATION	UNITS	RESULTS	DATE	TIME	USER	SITE	ROOM CHOICE	STRUCTURE	MEMBER	SUBSTRATE	CONDITION
1	1	mg/cm2	Positive	12/16/2021	12:58:47	HDHT	5305 Hollins	Calibration				
2	0	mg/cm2	Negative	12/16/2021	13:01:22	HDHT	5305 Hollins	Room 1	Room	Wall	Concrete	
3	0.1	mg/cm2	Negative	12/16/2021	13:03:11	HDHT	5305 Hollins	Room 1	Column		Metal	
4	0.5	mg/cm2	Negative	12/16/2021	13:03:36	HDHT	5305 Hollins	Room 1	Column		Metal	
5	0.3	mg/cm2	Negative	12/16/2021	13:03:56	HDHT	5305 Hollins	Room 1	Column		Metal	
6	0	mg/cm2	Negative	12/16/2021	13:04:58	HDHT	5305 Hollins	Room 1	Room	Wall	Concrete	
7	0.2	mg/cm2	Negative	12/16/2021	13:05:27	HDHT	5305 Hollins	Room 1	Room	Wall	Concrete	
8	0	mg/cm2	Negative	12/16/2021	13:06:22	HDHT	5305 Hollins	Room 1	Door		Wood	
9	-0.1	mg/cm2	Negative	12/16/2021	13:06:53	HDHT	5305 Hollins	Room 1	Door	Casing	Wood	
10	0	mg/cm2	Negative	12/16/2021	13:08:01	HDHT	5305 Hollins	Room 2	Column		Metal	
11	0.2	mg/cm2	Negative	12/16/2021	13:08:26	HDHT	5305 Hollins	Room 2	Column		Metal	
12	0	mg/cm2	Negative	12/16/2021	13:14:40	HDHT	5305 Hollins	Hallway 1	Door	Casing	Metal	
13	0	mg/cm2	Negative	12/16/2021	13:14:57	HDHT	5305 Hollins	Hallway 1	Door	Casing	Metal	
14	0.1	mg/cm2	Negative	12/16/2021	13:15:18	HDHT	5305 Hollins	Hallway 1	Door	Casing	Metal	
15	0.1	mg/cm2	Negative	12/16/2021	13:15:39	HDHT	5305 Hollins	Hallway 1	Window	Casing	Metal	
16	0.2	mg/cm2	Negative	12/16/2021	13:16:52	HDHT	5305 Hollins	Room 3	Window	Casing	Wood	
17	0	mg/cm2	Negative	12/16/2021	13:17:38	HDHT	5305 Hollins	Room 3	Window	Casing	Wood	
18	-0.1	mg/cm2	Negative	12/16/2021	13:18:26	HDHT	5305 Hollins	Room 3	Door	Casing	Metal	
19	0	mg/cm2	Negative	12/16/2021	13:18:57	HDHT	5305 Hollins	Room 3	Door		Metal	
20	0	mg/cm2	Negative	12/16/2021	13:19:20	HDHT	5305 Hollins	Room 3	Door		Metal	
21	0	mg/cm2	Negative	12/16/2021	13:20:27	HDHT	5305 Hollins	Room 3	Door		Metal	
22	0.2	mg/cm2	Negative	12/16/2021	13:22:19	HDHT	5305 Hollins	Bathroom 1	Room	Wall	Drywall	
23	0.1	mg/cm2	Negative	12/16/2021	13:23:15	HDHT	5305 Hollins	Bathroom 1	Room	Wall	Tile	
24	0	mg/cm2	Negative	12/16/2021	13:23:47	HDHT	5305 Hollins	Bathroom 1	Radiator		Metal	
25	31	mg/cm2	Positive	12/16/2021	13:24:29	HDHT	5305 Hollins	Bathroom 1	Sink		Metal	
26	-0.4	mg/cm2	Negative	12/16/2021	13:24:59	HDHT	5305 Hollins	Bathroom 1	Sink		Metal	
27	31	mg/cm2	Positive	12/16/2021	13:25:16	HDHT	5305 Hollins	Bathroom 1	Sink		Metal	
28	0.1	mg/cm2	Negative	12/16/2021	13:28:54	HDHT	5305 Hollins	Room 4	Room	Wall	Drywall	
29	0.1	mg/cm2	Negative	12/16/2021	13:33:33	HDHT	5305 Hollins	Room 4	Room	Wall	Drywall	
30	0.1	mg/cm2	Negative	12/16/2021	13:33:56	HDHT	5305 Hollins	Room 4	Room	Wall	Drywall	
31	0.8	mg/cm2	Negative	12/16/2021	13:34:43	HDHT	5305 Hollins	Room 4	Room	Wall	Drywall	
32	0	mg/cm2	Negative	12/16/2021	13:35:24	HDHT	5305 Hollins	Room 4	Room	Wall	Drywall	
33	0	mg/cm2	Negative	12/16/2021	13:36:00	HDHT	5305 Hollins	Room 4	Room	Wall	Drywall	
34	0	mg/cm2	Negative	12/16/2021	13:36:21	HDHT	5305 Hollins	Room 4	Door	Casing	Metal	
35	0.1	mg/cm2	Negative	12/16/2021	13:37:05	HDHT	5305 Hollins	Room 4	Window	Casing	Wood	
36	-0.1	mg/cm2	Negative	12/16/2021	13:39:14	HDHT	5305 Hollins	Room 4	Window	Casing	Wood	
37	0.2	mg/cm2	Negative	12/16/2021	13:39:31	HDHT	5305 Hollins	Room 4	Door		Metal	



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Lead Testing for Construction

Roanoke County General Services
Roanoke, VA

5305 Hollins Road
Roanoke, VA 24019

READING	CONCENTRATION	UNITS	RESULTS	DATE	TIME	USER	SITE	ROOM CHOICE	STRUCTURE	MEMBER	SUBSTRATE	CONDITION
38	0.7	mg/cm2	Negative	12/16/2021	13:40:18	HDHT	5305 Hollins	Room 4	Room	Wall	Drywall	
39	0.2	mg/cm2	Negative	12/16/2021	13:40:59	HDHT	5305 Hollins	Room 4	Room	Wall	Drywall	
40	0.1	mg/cm2	Negative	12/16/2021	13:48:22	HDHT	5305 Hollins	Room 4	Room	Wall	Drywall	
41	31	mg/cm2	Positive	12/16/2021	14:01:53	HDHT	5305 Hollins	Bathroom 2	Sink		Metal	
42	0	mg/cm2	Negative	12/16/2021	14:05:03	HDHT	5305 Hollins	Bathroom 2	Toilet		Metal	
43	19.8	mg/cm2	Positive	12/16/2021	14:05:27	HDHT	5305 Hollins	Bathroom 2	Sink		Metal	
44	25.8	mg/cm2	Positive	12/16/2021	14:05:45	HDHT	5305 Hollins	Bathroom 2	Sink		Metal	
45	0.4	mg/cm2	Negative	12/16/2021	14:06:30	HDHT	5305 Hollins	Room 5	Room	Wall	Drywall	
46	0	mg/cm2	Negative	12/16/2021	14:08:58	HDHT	5305 Hollins	Room 5	Room	Wall	Drywall	
47	0.1	mg/cm2	Negative	12/16/2021	14:09:16	HDHT	5305 Hollins	Room 5	Room	Wall	Drywall	
48	-0.1	mg/cm2	Negative	12/16/2021	14:11:00	HDHT	5305 Hollins	Room 5	Door	Casing	Metal	
49	0.1	mg/cm2	Negative	12/16/2021	14:12:55	HDHT	5305 Hollins	Bathroom 3	Sink		Metal	
50	0.3	mg/cm2	Negative	12/16/2021	14:13:15	HDHT	5305 Hollins	Room 6	Room	Wall	Drywall	
51	0.1	mg/cm2	Negative	12/16/2021	14:13:37	HDHT	5305 Hollins	Room 6	Room	Wall	Drywall	
52	0	mg/cm2	Negative	12/16/2021	14:13:59	HDHT	5305 Hollins	Room 6	Door	Casing	Metal	
53	0	mg/cm2	Negative	12/16/2021	14:14:29	HDHT	5305 Hollins	Room 6	Window	Casing	Metal	
54	0.1	mg/cm2	Negative	12/16/2021	14:14:45	HDHT	5305 Hollins	Room 6	Window	Casing	Metal	
55	0.1	mg/cm2	Negative	12/16/2021	14:15:06	HDHT	5305 Hollins	Room 7	Room	Wall	Drywall	
56	-0.1	mg/cm2	Negative	12/16/2021	14:15:50	HDHT	5305 Hollins	Room 7	Room	Wall	Drywall	
57	0.1	mg/cm2	Negative	12/16/2021	14:16:04	HDHT	5305 Hollins	Room 8	Window	Casing	Metal	
58	0.1	mg/cm2	Negative	12/16/2021	14:17:14	HDHT	5305 Hollins	Room 8	Room	Wall	Drywall	
59	-0.1	mg/cm2	Negative	12/16/2021	14:17:48	HDHT	5305 Hollins	Room 8	Door		Metal	
60	0.3	mg/cm2	Negative	12/16/2021	14:19:55	HDHT	5305 Hollins	Exterior	Door	Casing	Metal	
61	0.3	mg/cm2	Negative	12/16/2021	14:20:30	HDHT	5305 Hollins	Exterior	Door	Casing	Metal	
62	0.1	mg/cm2	Negative	12/16/2021	14:20:57	HDHT	5305 Hollins	Exterior	Door	Casing	Metal	
63	0.5	mg/cm2	Negative	12/16/2021	14:21:39	HDHT	5305 Hollins	Exterior	Exterior	Wall	Metal	
64	0	mg/cm2	Negative	12/16/2021	14:22:00	HDHT	5305 Hollins	Exterior	Exterior	Wall	Metal	
65	0.2	mg/cm2	Negative	12/16/2021	14:22:24	HDHT	5305 Hollins	Exterior	Exterior	Wall	Metal	
66	0	mg/cm2	Negative	12/16/2021	14:23:26	HDHT	5305 Hollins	Exterior	Exterior	Wall	Metal	
67	0.3	mg/cm2	Negative	12/16/2021	14:23:45	HDHT	5305 Hollins	Exterior	Railing	Bollard	Metal	
68	0	mg/cm2	Negative	12/16/2021	14:24:03	HDHT	5305 Hollins	Exterior	Railing	Bollard	Metal	
69	0.2	mg/cm2	Negative	12/16/2021	14:24:36	HDHT	5305 Hollins	Exterior	Railing	Railing	Metal	
70	0.1	mg/cm2	Negative	12/16/2021	14:25:22	HDHT	5305 Hollins	Exterior	Railing	Railing	Metal	
71	0.1	mg/cm2	Negative	12/16/2021	14:29:58	HDHT	5305 Hollins	Exterior	Bollard	Bollard	Metal	
72	0	mg/cm2	Negative	12/16/2021	14:30:36	HDHT	5305 Hollins	Exterior	Bollard	Bumper	Metal	
73	0.2	mg/cm2	Negative	12/16/2021	14:31:01	HDHT	5305 Hollins	Exterior	Railing	Fascia	Metal	
74	0.1	mg/cm2	Negative	12/16/2021	14:32:31	HDHT	5305 Hollins	Exterior	Railing	Fascia	Metal	



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Lead Testing for Construction

Roanoke County General Services
Roanoke, VA
5305 Hollins Road
Roanoke, VA 24019

READING	CONCENTRATION	UNITS	RESULTS	DATE	TIME	USER	SITE	ROOM CHOICE	STRUCTURE	MEMBER	SUBSTRATE	CONDITION
75	1	mg/cm2	Positive	12/16/2021	14:36:01	HDHT	5305 Hollins	Calibration				

Photos

5305 Hollins Road



All Floor Tile and Associated Mastic (Excluding gray floor tile in customer entrance and black floor tile in storage area) was found to be asbestos containing by the laboratory.

5305 Hollins Road



All Floor Tile and Associated Mastic (Excluding gray floor tile in customer entrance and black floor tile in storage area) was found to be asbestos containing by the laboratory.

5305 Hollins Road



All Floor Tile and Associated Mastic (Excluding gray floor tile in customer entrance and black floor tile in storage area) was found to be asbestos containing by the laboratory.

5305 Hollins Road



All Floor Tile and Associated Mastic (Excluding gray floor tile in customer entrance and black floor tile in storage area) was found to be asbestos containing by the laboratory.

5305 Hollins Road



All Floor Tile and Associated Mastic (Excluding gray floor tile in customer entrance and black floor tile in storage area) was found to be asbestos containing by the laboratory.

5305 Hollins Road



Window and Door Framing Caulk were found to be asbestos containing by the laboratory.

5305 Hollins Road



For informational purposes, the painted metal sinks were sampled and identified to be lead components. Although not included in the Virginia Lead-based Paint Activities Regulations, the contractor should be provided this information in the event these items are removed for disposal purposes.

Applicable Licenses

CERTIFICATE


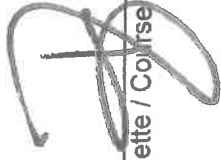
This Certifies That

Frederick R. Danner

755 B West Main Street
Christiansburg, VA 24073

**Has Attended and Successfully Completed an
Examination for the Training Course Entitled:**

8-HOUR LEAD INSPECTOR REFRESHER

V21-0142	November 11, 2021	November 11, 2021	Blacksburg, Virginia
Certificate Number	Course Dates	Examination Date	Course Location
		November 11, 2024	
Dave Violette / Training Manager		Expiration Date	Dave Violette / Course Instructor

This Course Fulfills The Requisite Training for Lead Accreditation Under TSCA, Sections 402/204

Dave Violette 120 Lovelane Street, Bluefield, VA 24605 ~ www.daveviolette.com
540.392.1660 ~ Mailing Address: Dave Violette PO Box 230, Blacksburg, VA 24063-0230

COMMONWEALTH of VIRGINIA

Department of Professional and Occupational Regulation

9960 Mayland Drive, Suite 400, Richmond, VA 23233

Telephone: (804) 367-8500

EXPIRES ON

11-30-2022

NUMBER

3356000422

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
LEAD RISK ASSESSOR LICENSEROBIN H LIEBAL
4659 HEAVENER RD.
RADFORD, VA 24141-0000A handwritten signature in black ink, appearing to read "Mary Broz-Vaughan".
Mary Broz-Vaughan, DirectorStatus can be verified at <http://www.dpor.virginia.gov>

(SEE REVERSE SIDE FOR PRIVILEGES AND INSTRUCTIONS)

DPOR-LIC (02/2017)

COMMONWEALTH of VIRGINIA

Department of Professional and Occupational Regulation
9960 Mayland Drive, Suite 400, Richmond, VA 23233
Telephone: (804) 367-8500

EXPIRES ON
12-31-2021

NUMBER
3303004480

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
ASBESTOS INSPECTOR LICENSE



JARED ALLEN CROWDER
5789 TABERNACLE PL
PULASKI, VA 24301



Mary Broz-Vaughan
Mary Broz-Vaughan, Director

Status can be verified at <http://www.dpor.virginia.gov>

(SEE REVERSE SIDE FOR PRIVILEGES AND INSTRUCTIONS)

DPOR-LIC (02/2017)