

PROJECT MANUAL SPECIFICATIONS

Ogden City Community Services Ballistic Upgrade and Remodel

Ogden, Utah

GSBS Project No. 2023.040.00



FOR REVIEW

March 12, 2025

TABLE OF CONTENTS

Division	Section Title	Pages
DIVISION 1 - GENERAL REQUIREMENTS		
010015	GENERAL MECHANICAL REQUIREMENTS	12
011000	SUMMARY	3
012500	SUBSTITUTION PROCEDURES	4
013100	PROJECT MANAGEMENT AND COORDINATION	10
013200	CONSTRUCTION PROGRESS DOCUMENTATION	9
013300	SUBMITTAL PROCEDURES	11
013300.1	SUBMITTAL FLOW CHART	1
013300.2	SUBMITTAL STAMP SHEET	1
017700	CLOSEOUT PROCEDURES	6
DIVISION 6 - WOOD AND PLASTICS		
061053	MISCELLANEOUS ROUGH CARPENTRY	5
064116	PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS	8
DIVISION 7 - THERMAL AND MOISTURE PROTECTION		
079200	JOINT SEALANTS	14
DIVISION 8 - DOORS AND WINDOWS		
081216	ALUMINUM FRAMES	4
081416	FLUSH WOOD DOORS	7
088000	GLAZING	13
088853	SECURITY GLAZING	8
DIVISION 9 - FINISHES		
092216	NON-STRUCTURAL METAL FRAMING	3
092900	GYPSUM BOARD	8
096813	TILE CARPETING	6
099123	INTERIOR PAINTING	8
DIVISION 22 - PLUMBING		
220523	VALVES	5
220529	HANGERS AND SUPPORTS	6
220548	MECHANICAL SOUND, VIBRATION, AND SEISMIC CONTROL	8
220553	MECHANICAL IDENTIFICATION	4
220700	MECHANICAL INSULATION	7
221100	DOMESTIC & INDUSTRIAL WATER PIPING	9
221300	SANITARY WASTE AND VENT PIPING	6

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

230593	TESTING, ADJUSTING, AND BALANCING	5
232116	PIPING SPECIALTIES	8
233100	DUCTS	5
233300	DUCT ACCESSORIES	5
234000	AIR CLEAN DEVICES	3

DIVISION 26 - ELECTRICAL

260001	ELECTRICAL GENERAL PROVISIONS	11
260070	ELECTRICAL CONNECTIONS FOR EQUIPMENT	3
260072	ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS	7
260110	CONDUIT RACEWAYS	5
260120	CONDUCTORS AND CABLES	6
260135	ELECTRICAL BOXES AND FITTINGS	4
260140	WIRING DEVICES	8
260180	OVERCURRENT PROTECTIVE DEVICES	3
260452	GROUNDING	4
260510	INTERIOR LIGHTING	14

DIVISION 27 – COMMUNICATIONS

270526	GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS	8
--------	--	---

END OF TABLE OF CONTENTS

SECTION 010015 - GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordination and project conditions.
- B. Products, product options and substitutions.
- C. Closeout procedures.
- D. Submittals.
- E. Test and inspection.
- F. Regulatory requirements.
- G. Cutting and patching.
- H. Special procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
- B. Provide all labor, materials and equipment necessary for completely finished and operational systems as described and specified.
- C. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.
- D. Coordinate space requirements, supports, and installation of mechanical Work indicated diagrammatically on Drawings. Follow routing shown 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. Provide incidental items such as offsets, fittings and accessories required for a completely operational mechanical system.
- E. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.

- F. Coordinate completion and clean-up of Work in preparation for Substantial Completion.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 SUBMITTAL PROCEDURES

- A. Transmit each submittal with Architect/Engineer accepted form.
- B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- C. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.
- D. 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 requirements of the Work and Contract Documents.
- E. Schedule submittals to expedite Project, and deliver to Architect/Engineer. Coordinate submission of related items.
- F. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.
- G. Identify variations from Contract Documents and product or system limitations, which may be detrimental to successful performance of completed Work.
- H. Allow space on submittals for Contractor and Architect/Engineer review stamps.
- I. When revised for resubmission, identify changes made since previous submission.
- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- K. Submittals not requested will not be recognized or processed.

1.4 PROPOSED PRODUCTS LIST

- A. Within 15 days after date of Owner-Contractor Agreement Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PRODUCT DATA

- A. Product Data: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents. Provide copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes as described.
- B. Submit number of copies Contractor requires, plus two copies Architect/Engineer will retain.
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. After review distribute in accordance with Submittal Procedures article above and provide copies for record documents described.

1.6 SHOP DRAWINGS

- A. Shop Drawings: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents. Produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01700.
- B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.7 TEST REPORTS

- A. Submit for Architect/Engineer's knowledge as contract administrator or for Owner.
- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.8 CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Architect/Engineer, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

1.9 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Architect/Engineer for delivery to Owner in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- C. For the custom built-up air handler, sheet metal contractor is responsible to provide & install all internal supports necessary. The air handler shall resemble the tightness of construction as a factory built Haakon or Scott Springfield Air Handler Unit. Poor craftsmanship in the construction of this air handler will not be accepted – this includes the door handles, base, floor, roof, doors, motorized dampers, coils, and pipe penetrations.

1.10 QUALITY CONTROL AND 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 manufacturer's instructions, including each step in sequence.
- C. When manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer 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. Perform Work by persons qualified to produce required and specified quality.
- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
- H. It is the contractors responsibility to not only ensure equipment is installed properly and has been started properly, but also that the "system" is operating properly. Air handlers can run, boilers can fire, chillers can start, but proper system operation of each individual equipment working together to maintain temperature, pressure, humidity, etc. is crucial.

- I. Mechanical contractor is to notify mechanical engineer of completion of air handling unit. AHU is to be pressurized and pressure tested for tightness, and leakage rate acceptable to engineer's approval.

1.11 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturer's tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.12 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard and all applicable codes, ordinances and regulations in effect, except where specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. When specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- E. Comply with the latest editions of the following:
 - a. 2021 International Mechanical Code;
 - b. 2021 International Plumbing Code;
 - c. 2021 International Building Code;
 - d. 2021 International Fuel Gas Code
 - e. NFPA 99
 - f. State Department of Health Standards
 - g. Model Energy Code;
 - h. National Fire Protection Standards;
 - i. National Electric Code;
 - j. Utah State Boiler Code;
- F. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Architect/Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.13 PRODUCTS

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.
- C. Furnish interchangeable components from same manufacturer for components being replaced.

1.14 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instruction.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.15 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

1.16 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: products of one of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.17 PRODUCT SUBSTITUTION PROCEDURES

- A. Architect/Engineer will consider requests for Substitutions only within 15 days after date established in Notice to Proceed.
- B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
 - 2. Will provide same warranty for Substitution as for specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.
- F. Substitution Submittal Procedure:
 - 1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
 - 2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
 - 3. Architect/Engineer will notify Contractor in writing of decision to accept or reject request.

1.18 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.

1.19 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
- C. Replace filters of operating equipment.
- D. Clean debris from roofs, gutters, downspouts, and drainage systems.
- E. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.20 STARTING OF SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect/Engineer seven days prior to start-up of each item.
- C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable manufacturer's representative and Contractors' personnel in accordance with manufacturers' instructions.
- G. 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.

1.21 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

- B. Demonstrate Project equipment and instruct by manufacturer's representative who is knowledgeable about the Project.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. 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.
- E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time agreed time, at designated location.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.22 TESTING, ADJUSTING AND BALANCING

- A. Independent firm will perform services specified in Section 230593.
- B. Reports will be submitted by independent firm to Architect/Engineer indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

1.23 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

1.24 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, not less than weekly.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. 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. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract drawings.
- G. Submit documents to Architect/Engineer.

1.25 OPERATION AND MAINTENANCE DATA

- A. Submit data bound in 8-1/2 x 11 inch (A4) text pages, three D side ring binders with durable plastic cloth covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:

GENERAL MECHANICAL REQUIREMENTS

010015 - 10

- a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for [special] finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
- 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties and bonds.

1.26 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned [after final inspection], with Architect/Engineer comments. Revise content of document sets as required prior to final submission.
- D. Submit three sets of revised final volumes in final form within 10 days after final inspection.
- E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- F. 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 special operating instructions.
- G. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- H. Include servicing and lubrication schedule, and list of lubricants required.
- I. Include manufacturer's printed operation and maintenance instructions.

GENERAL MECHANICAL REQUIREMENTS

010015 - 11

- J. Include sequence of operation by controls manufacturer.
- K. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- L. Include control diagrams by controls manufacturer as installed.
- M. Include Contractor's coordination drawings, with color coded piping diagrams as installed.
- N. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- O. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- P. Include test and balancing reports as specified in Section 230593.
- Q. Additional Requirements: As specified in individual product specification sections.
- R. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.27 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.
- B. Deliver to Project site. Obtain receipt.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION 010015

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Project information.
- 2. Work covered by Contract Documents.
- 3. Work by Owner.
- 4. Owner-furnished products.
- 5. Contractor-furnished, Owner-installed products.
- 6. Access to site.
- 7. Work restrictions.
- 8. Specification and drawing conventions.

- B. Related Requirements:

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

1.3 PROJECT INFORMATION

- A. Project Identification: Ogden Community Services Ballistic Upgrade and Remodel.

- 1. Project Location: 1875 Monroe Blvd, Ogden, Utah 84401.

- B. Owner: Ogden City
133 West 29th Street
Ogden, Utah 84401.

- 1. Owner's Representative: Monica Kapp (tel. (801) 629-8364).

- C. Architect: GSBS Architects; Brock Peterson (tel. 801-521-8600).

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

- 1. Structural Engineering: Dunn Associates; Jake Dunn (tel. 801-575-8877).
- 2. Mechanical Engineering: PVE Engineering; Issac Hansen (tel. 801-359-3158).
- 3. Electrical Engineering: Envision Engineering; Aleksandar Rankovic (tel. 801-534-1130).

SUMMARY

011000 - 1

- E. Project Information Exchange Site: A project Information Exchange site administered by Architect will be used for purposes of managing communication and documents during the construction stage.
 - 1. See Section 013100 "Project Management and Coordination." for requirements for using the Project Web site.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. Project consists of Ogden Community Services Ballistic Upgrade and Remodel.
 - a. Code Classification: Construction Type IIB, Fully Sprinkled.
 - b. Occupancy Classification: B.
 - c. Addition of interior and exterior ballistic rated windows, doors, transaction windows, walls and remodel of reception area, interior offices, break room and conference room.
- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract.

1.5 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Discuss with owner at start of the project, prior to construction, to determine limits of construction on the site.
 - 2. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

1.6 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions prior to and after award of Contract.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents after award of Contract.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing by prime contract Bidder only in compliance with the following requirements:
 - 1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.

SUBSTITUTION PROCEDURES

012500 - 1

2. Submittal Format: Submit Procurement Substitution Request, using electronic media.

- a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
- b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:
 - 1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
 - 2) Copies of current, independent third-party test data of salient product or system characteristics.
 - 3) Samples where applicable or when requested by Architect.
 - 4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - 5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - 6) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES.
 - 7) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.
- c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.
- d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

3. Architect's Action:

- a. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

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

- 1. Substitution Request Form: Use form acceptable to Architect.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SUBSTITUTION PROCEDURES

012500 - 4

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Information exchange web site.
 - 5. Project meetings.
- B. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally 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. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

- c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
- d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
- e. Indicate required installation sequences.
- f. 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 inches in 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 center lines.
- 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 Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
10. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in Revit 2023.
 - c. Contractor shall execute a data licensing agreement in the form of AIA Document C106 or form acceptable to the Architect.

1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

- C. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B or form acceptable to the Architect. Include the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.8 INFORMATION EXCHANGE WEB SITE

- A. Contractor shall use Architects Information Exchange web site for purposes of project communication and documentation with Architect and Owner until Final Completion. Information Exchange web site shall include the following functions:
 - 1. Project directory.
 - 2. Contract modifications (ASI, PR, COR, CCD, CO).
 - 3. RFI.
 - 4. Submittals.
 - 5. Site Observation.
 - 6. Payment.
 - 7. Punch List.
 - 8. Reminder and tracking functions.
- B. Contractor shall not use the Architects Information Exchange web site for communication with or management of subcontractors.

1.9 PROJECT MEETINGS

- A. General: Contractor shall schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within seven days of the meeting.
- B. Preconstruction Conference: Contractor shall schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 - 1. Conduct the conference to review responsibilities and personnel assignments.
 - 2. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.

- i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Preparation of record documents.
 - m. Use of the premises and existing building.
 - n. Work restrictions.
 - o. Working hours.
 - p. Owner's occupancy requirements.
 - q. Responsibility for temporary facilities and controls.
 - r. Procedures for moisture and mold control.
 - s. Procedures for disruptions and shutdowns.
 - t. Construction waste management and recycling.
 - u. Parking availability.
 - v. Office, work, and storage areas.
 - w. Equipment deliveries and priorities.
 - x. First aid.
 - y. Security.
 - z. Progress cleaning.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.

- r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Contractor shall schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 60 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Owner's partial occupancy requirements.
 - k. Installation of Owner's furniture, fixtures, and equipment.
 - l. Responsibility for removing temporary facilities and controls.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

- E. Progress Meetings: Contractor shall conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Special reports.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
- B. Startup construction schedule.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.

- G. Daily Construction Reports: Submit at weekly intervals.
- H. Material Location Reports: Submit at monthly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including phasing work stages area separations interim milestones and partial Owner occupancy.
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review schedule for work of Owner's separate contracts.
 - 6. Review submittal requirements and procedures.
 - 7. Review time required for review of submittals and resubmittals.
 - 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 9. Review time required for Project closeout and Owner startup procedures.
 - 10. Review and finalize list of construction activities to be included in schedule.
 - 11. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice of Award to date of Substantial Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - a. Structural Steel.
 - b. Aluminum windows.
 - c. Aluminum doors.
 - d. Air Handling Units.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

5. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.

- F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
 - 1. Use Meridian Prolog or software approved by Architect, for Windows operating system.

2.2 STARTUP CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice of Award.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice of Award. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice of Award.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- E. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.

3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

F. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

G. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

H. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
 - 1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 - 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.
 - j. Activity or event number.
- B. Look Ahead Submittal Schedule: Rolling 90 day schedule of upcoming submittals.
1. Provide at start of project.
 2. Update on the same time frame as progress meetings.
 3. Review in progress meetings.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data File: Electronic digital data file of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals as provided for in either paragraph 1 or paragraph 2 as follows:
1. Architect will furnish Contractor a digital data drawing file of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

SUBMITTAL PROCEDURES

013300 - 2

- a. Digital Drawing Software Program: The Building Information Model that includes the views from which the Contract Documents were created is available in the current version of Autodesk Revit.
 - b. Use of, and reliance upon, the Building Information Model by the Contractor, its sub-contractors and suppliers of any tier is subject to the AIA E203 - Building Information Modeling and Digital Data Exhibit, included in the Contract Documents, and the current G202, Project Building Information Modeling Protocol Form.
 - c. If the Contract Documents do not include an AIA E203 - Building Information Modeling and Digital Data Exhibit, the Building information Model will not be available for the Contractor's use.
2. In the event that the Building Information Model is not available, or the Contractor does not intend to use that format, the Architect may furnish Contractor digital data drawing files of limited portions of the Contract Drawings for use in preparing Shop Drawings and Project record drawings with the following conditions:
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Digital Drawing Software Program: The Contract Drawings will be made available in the current version of Autodesk AutoCad.
 - c. Contractor will execute a GSBS Architects Conditional Release Agreement.
 - d. The following digital data files are available, for each appropriate discipline, at a cost to the Contractor of \$50.00 per sheet:
 - 1) Site plans.
 - 2) Floor plans.
 - 3) Reflected ceiling plans.
- B. Electronic Submittal Flow Chart: This flow chart will outline the electronic submittal process that will be followed for this project. An example is included at the end of this section.
 1. A pre-construction conference shall be schedule to review the submittal procedures and refine the Flow Chart as necessary due to the particular demands of the project.
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- D. Quantity of Submittals: Contractor shall coordinate schedule so that there are no more than a total of 15 submittals or a total of 500 sheets for review at any single time in the schedule.
- E. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 10 days for review of each resubmittal.
- F. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
 - 1. Refer to Electronic Submittal Flow Chart at the end of this section.
 - 2. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 - 3. Name file as outlined in Electronic Submittal Flow Chart.
 - 4. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 - a. Use review stamp sheet provided by Architect at the end of this section.
 - 5. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Architect, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number, numbered consecutively.
 - p. Submittal and transmittal distribution record.

- q. Other necessary identification.
 - r. Remarks.
6. Metadata: Include the following information as keywords in the electronic submittal file metadata:
- a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- G. Options: Identify options requiring selection by Architect.
- H. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
 - 4. On an attached separate sheet, prepared on Contractor's letterhead, record all new and/or revised information from the original submittal.
- J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- K. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
- 1. Post electronic submittals as PDF electronic files directly to Info Exchange site specifically established for Project.

SUBMITTAL PROCEDURES

013300 - 5

- a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. Searchable PDF electronic file with bookmarks for all the sections.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.

- d. Routh-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 - m. Relationship and attachment to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer if specified.
- 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 - 3. Submit Shop Drawings in the following format:
 - a. Searchable PDF electronic file with bookmarks of all the sections.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
- 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 - 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 - 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 - 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

- a. Number of Samples: Submit three full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 - 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 - 2. Manufacturer and product name, and model number if applicable.
 - 3. Number and name of room or space.
 - 4. Location within room or space.
 - 5. Submit product schedule in the following format:
 - a. Searchable PDF electronic file with bookmarks for all the sections.
- F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.

- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

SUBMITTAL PROCEDURES

013300 - 10

- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

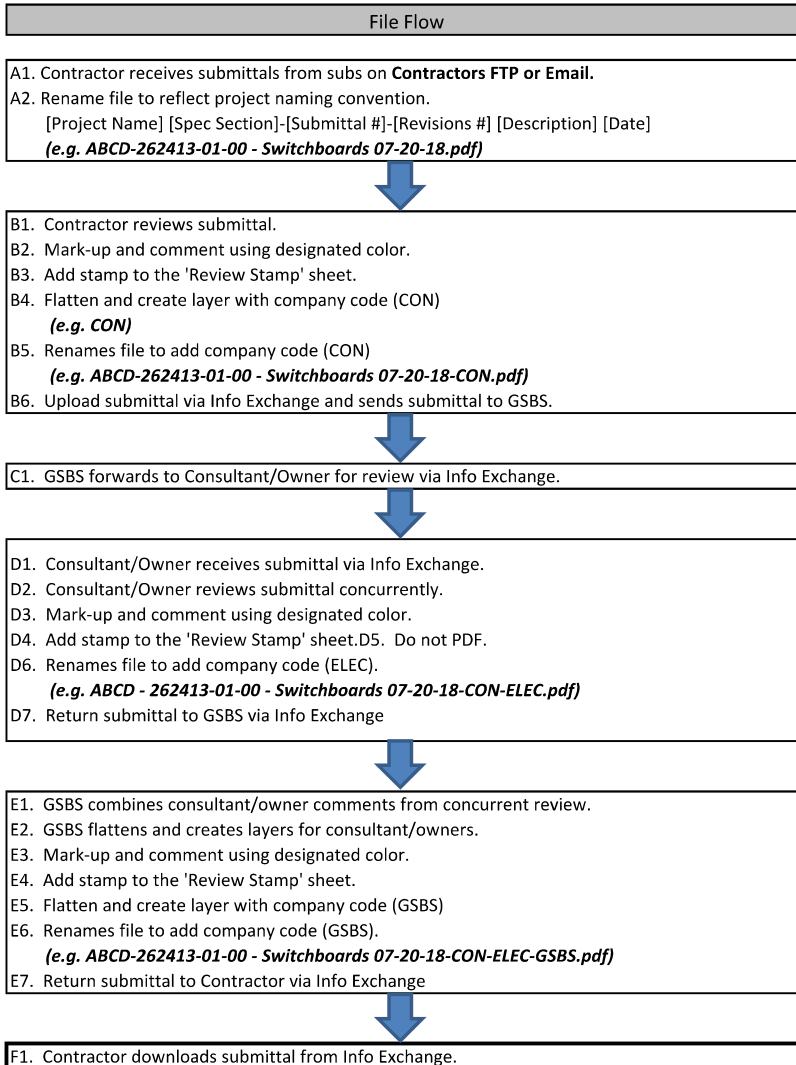
3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

Electronic Submittal Flow Chart

01.02.2023



Reviewer	Person	Code	Color
Contractor		CON	Green (10)
GSBS Architects	Cathy Davison	GSBS	Red (12)
Electrical Engineer		ELEC	Blue (11)
Mechanical Engineer		MECH	Orange (8)
Structural Engineer		STRUC	Maroon (7)
Landscape Architect		GSBS	Red (12)
Civil Engineer		CVL	Violet (13)
Commissioning Agent		COMM	Magenta (14)
Owner		OWN	Brown (1)



REVIEW STAMPS FOR PROJECT:

Required Reviewers

- ☐ ARCHITECTURAL
- ☐ CIVIL
- ☐ ACOUSTICAL
- ☐ COMMISSIONING
- ☐ AHJ
- ☐ STRUCTURAL
- ☐ INTERIORS
- ☐ HARDWARE
- ☐ OWNER
- ☐ DETENTION
- ☐ MECHANICAL
- ☐ LANDSCAPE
- ☐ A/V
- ☐ SIGNAGE
- ☐ ELECTRICAL
- ☐ KITCHEN PRODUCTS
- ☐ ENVELOPE
- ☐ SUSTAINABILITY

<div><u>GENERAL CONTRACTOR</u></div>	<div><u>ARCHITECT</u></div>
<div><u>CONSULTANT</u></div>	<div><u>CONSULTANT</u></div>

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

CLOSEOUT PROCEDURES

017700 - 1

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 - 5. Submit test/adjust/balance records.
 - 6. Submit sustainable design submittals not previously submitted.
 - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 - 6. Advise Owner of changeover in heat and other utilities.
 - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.

CLOSEOUT PROCEDURES

017700 - 2

8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

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

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

1.7 FINAL COMPLETION PROCEDURES

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

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.

CLOSEOUT PROCEDURES

017700 - 3

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
4. Submit list of incomplete items in the following format:
 - a. MS Excel and PDF electronic file. Architect will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.

CLOSEOUT PROCEDURES

017700 - 5

- j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
- k. Remove labels that are not permanent.
- l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
- p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
- q. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

CLOSEOUT PROCEDURES

017700 - 6

**OGDEN COMMUNITY SERVICES BALLISTIC UPGRADE AND REMODEL
GSBS PROJECT. NO. 2023.040.00**

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Wood blocking and nailers.
 - 2. Plywood backing panels.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Preservative-treated wood.
 - 2. Power-driven fasteners.
 - 3. Post-installed anchors.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
- B. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

MISCELLANEOUS ROUGH CARPENTRY

061053 - 2

- C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing: ASTM C 1002 or ASTM C 954 as applicable, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.6 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

MISCELLANEOUS ROUGH CARPENTRY

061053 - 3

- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- F. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

MISCELLANEOUS ROUGH CARPENTRY

061053 - 4

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Plastic-laminate-faced architectural cabinets.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, fire-retardant-treated materials, cabinet hardware and accessories.

Shop Drawings:

- 1. Include plans, elevations, sections, and attachment details.
- 2. Show large-scale details.

3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
5. Apply AWI Quality Certification Program label to Shop Drawings.

B. Samples for Initial Selection:

1. Plastic laminates.
2. PVC edge material.
3. Thermoset decorative panels.

C. Samples for Verification:

1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.
 - a. Provide one sample applied to core material with specified edge material applied to one edge.
2. Thermoset Decorative Panels: 8 by 10 inches, for each color, pattern, and surface finish.
 - a. Provide edge banding on one edge.
3. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

D. INFORMATIONAL SUBMITTALS

E. Qualification Data: For Installer and fabricator.

F. Product Certificates: For the following:

1. Thermoset decorative panels.
2. High-pressure decorative laminate.
3. Adhesives.

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 17 and 50 percent during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET FABRICATORS

- A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of architectural wood cabinets with sequence-matched wood veneers wood paneling and transparent-finished wood doors that are required to be of same species as woodwork.
- B. Fabricators: Subject to compliance with requirements, available fabricators offering products that may be incorporated into the Work include the following:
 - 1. JLR-Fondell Woodwork.
 - 2. Fetzer's Inc.
 - 3. Masterpiece Commercial Millwork.
 - 4. Boswell Wasatch.
 - 5. Huetter Mill.

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. Provide certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.

PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

064116 - 3

- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, provide products as listed in the Finish Schedule which is part of the construction drawing set.
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade VGS.
 - 4. Edges: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
 - 5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- G. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
 - b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
 - c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
 - 3. Drawer Bottoms: Thermoset decorative panels.
- H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.
- K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. Match Architect's sample. See finish schedule in Construction Documents.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
 - 2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 - 3. Softwood Plywood: DOC PS 1, medium-density overlay.
 - 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
 - 5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.
- C. Back-Mounted Pulls: BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- E. Catches: Magnetic catches, BHMA A156.9, B03141.
- F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081; BHMA A156.9, B04102; with shelf brackets, B04112.
- G. Shelf Rests: ANSI/BHMA A156.9, B04013; metal. Finish: Stainless steel.
- H. Adjustable Shelf Pins: 5 mm metal pins. Finish: Stainless steel.
- I. Drawer Slides: BHMA A156.9.
 - 1. Grade 1 and Grade 2: Side mounted; full-extension type; zinc-plated steel with steel ball-bearing slides.
 - 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.

3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 2.
 4. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.
 5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
- J. Door Locks: BHMA A156.11, E07121. Finish: Brushed Stainless.
- K. Drawer Locks: BHMA A156.11, E07041. Finish: Brushed Stainless.
- L. Grommets for Cable Passage through Countertops: 2 3/8-inch OD, grommets and matching metal caps with slot for wire passage.
1. Product: Subject to compliance with requirements, provide the following:
 - a. Manufacturer: Doug Mockett & Company, Inc.
 - b. Product: #TG-TG Flip-Top Series, 2" Hole Desk Grommet.
 - c. Finish: #26D Satin Chrome.
 - d. See Construction Drawings for required locations.
- M. Door and Drawer Silencers: BHMA A156.16, L03011.
- N. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: ANSI/BHMA 630.
- O. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. 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.

2.6 FABRICATION

- A. Fabricate cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, 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.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches3 mm in 2400 mm
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.

- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38 mm) penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Latex joint sealants.

B. Related Requirements:

1. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Latex joint sealants.

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

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

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

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

JOINT SEALANTS

079200 - 1

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

B. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested from sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

D. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
 3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with substrates.
 4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
 5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
 7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 2. Conduct field tests for each kind of sealant and joint substrate.
 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 5. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 6. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 7. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 SILICONE JOINT SEALANTS - SJS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Pecora Corporation
 - 2. Sika Corporation - Building Components.
 - 3. The Dow Chemical Company.

4. Tremco Incorporated
 - B. SJS#01: 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 T, NT; SWRI Validation.
 1. Basis-of-Design Product: DOWSIL 790 Silicone Building Sealant.
 - a. Hardness, ASTM C661: 15 durometer Shore A.
 - b. Volatile Organic Compound (VOC) Content: 26 g/L maximum.
 - c. Staining, ASTM C1248: None on concrete, granite, limestone and brick.
 - C. SJS#02: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT; SWRI validation.
 1. Basis-of-Design Product: DOWSIL 756 SMS Building Sealant.
 - a. Hardness, ASTM C661: 35 durometer Shore A.
 - b. Volatile Organic Compound (VOC) Content: 60 g/L maximum.
 - c. Staining, ASTM C1248: None on white marble.
 - D. SJS#03: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT, G, M and A; SWRI validation.
 1. Basis-of-Design Product: DOWSIL 791 Silicone Weatherproofing Sealant.
 - a. Hardness, ASTM C661: 34 durometer Shore A.
 - b. Volatile Organic Compound (VOC) Content: 30 g/L maximum.
 - c. Staining, ASTM C1248: None on concrete, granite, limestone and brick.
 - E. SJS#04: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT, G, A and O; SWRI validation.
 1. Basis-of-Design Product: DOWSIL 795 Silicone Building Sealant.
 - a. Hardness, ASTM C661: 35-45 durometer Shore A.
 - b. Volatile Organic Compound (VOC) Content: 32 g/L maximum.
 - c. Staining, ASTM C1248: None on concrete, granite, limestone and brick.
 - F. SJS#05: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT; SWRI validation.
 1. Basis-of-Design Product: DOWSIL 995 Silicone Structural Sealant.

- a. Hardness, ASTM D2240: 35-45 durometer Shore A.
 - b. Volatile Organic Compound (VOC) Content: 34 g/L maximum.
 - c. Ultimate Tensile, ASTM C1135: 160 psi (1.1 MPa), at 21 day cure (TA joint).
- G. SJS#06: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - 1. Basis-of-Design Product: DOWSIL 758 Silicone Weather Barrier Sealant.
 - a. Hardness, ASTM D2240: 45 durometer Shore A.
 - b. Volatile Organic Compound (VOC) Content: 61 g/L maximum.
 - c. Color: White.
- H. SJS#07: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - 1. Basis-of-Design Product: DOWSIL 999A Silicone Building & Glazing Sealant.
 - a. Hardness, ASTM C661: 25 durometer Shore A.
 - b. Volatile Organic Compound (VOC) Content: 36 g/L maximum.
 - c. Ultimate Tensile, ASTM D412: 325 psi (1.2 MPa), at 21 day cure (Dumbell).

2.4 NONSTAINING SILICONE JOINT SEALANTS - NSJS

- A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Pecora Corporation
 - 2. Sika Corporation - Building Components.
 - 3. The Dow Chemical Company.
 - 4. Tremco Incorporated
- C. NSJS#01: Nonstaining, 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; SWRI validated.
 - 1. Basis-of-Design Product: Tremco, Inc., Spectrem 1.
 - a. Hardness, ASTM C661: 15 durometer Shore A.
 - b. Volatile Organic Compound (VOC) Content: 1 g/L maximum.
 - c. Staining, ASTM C1248: None on concrete, marble, granite, limestone and brick.

- D. NSJS#02: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT; SWRI validated.
1. Basis-of-Design Product: Tremco, Inc., Spectrem 2.
 - a. Hardness, ASTM C661: 37-40 durometer Shore A.
 - b. Volatile Organic Compound (VOC) Content: 50 g/L maximum.
 - c. Staining, ASTM C1248: None on concrete, marble, granite, limestone and brick.
- E. NSJS#03: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
1. Basis-of-Design Product: Tremco, Inc., Spectrem 3.
 - a. Hardness, ASTM C661: 15 durometer Shore A.
 - b. Volatile Organic Compound (VOC) Content: 20 g/L maximum.
 - c. Staining, ASTM C1248: None on concrete, marble, granite, limestone and brick.
- F. NSJS#04: Nonstaining, multi-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.
1. Basis-of-Design Product: Tremco, Inc., Spectrem 4-TS.
 - a. Hardness, ASTM C661: 15 durometer Shore A.
 - b. Volatile Organic Compound (VOC) Content: 20 g/L maximum.
 - c. Staining, ASTM C1248: None on concrete, marble, granite, limestone and brick.

2.5 URETHANE JOINT SEALANTS - UJS

- A. UJS#01: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
1. Basis-of-Design Product: Tremco, Inc., Dymonic 100.
 - a. Hardness, ASTM C661: 35-45 durometer Shore A.
 - b. Tensile Strength, ASTM D412: 350-450 psi.
 - c. Percent Elongation, ASTM D412: 800-900%
 - d. Modulus at 100%, ASTM D412: 75-85 psi.
 - e. Tear Strength, ASTM D412: 65-75 psi.
 - f. Volatile Organic Compound (VOC) Content: 40 g/L maximum.
- B. UJS#02: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT; Greenguard certified.

1. Basis-of-Design Product: Tremco, Inc., Dymonic FC.
 - a. Hardness, ASTM C661: 25-50 durometer Shore A.
 - b. Extrusion Rate, ASTM C1183: 93.1 mL/min.
 - c. Weight Loss, ASTM C1246: Pass.
 - d. Tack Free Time, ASTM C679: 3-4 hr.
 - e. Volatile Organic Compound (VOC) Content: 10 g/L maximum.
- C. UJS#03: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 1. Basis-of-Design Product: Tremco, Inc., Vulkem 116.
 - a. Hardness, ASTM C661: 40 durometer Shore A.
 - b. Volatile Organic Compound (VOC) Content: 60 g/L maximum.

2.6 LATEX JOINT SEALANTS - LJS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Pecora Corporation
 2. Sika Corporation - Building Components.
 3. The Dow Chemical Company.
 4. Tremco Incorporated
- B. LJS#01: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
 1. Basis-of-Design Product: Tremco, Inc. Tremflex 834.
 - a. Volatile Organic Compound (VOC) Content: 35 g/L maximum.
 - b. Color: White, paintable.

2.7 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.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Adfast.
 - b. Alcot Plastics Ltd.
 - c. Construction Foam Products; a division of Nomaco, Inc.

- d. Master Builders Solutions; brand of MBCC Group.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
 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.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. 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.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - a. Extent of Testing: Test completed and cured sealant joints as follows:
 - 1) Perform 10 tests for the first 1000 ft. (300 m) of joint length for each kind of sealant and joint substrate.
 - 2) Perform one test for each 1000 ft. (300 m) of joint length thereafter or one test per each floor per elevation.
 - b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - c. Inspect tested joints and report on the following:
 - 1) Whether sealants filled joint cavities and are free of voids.
 - 2) Whether sealant dimensions and configurations comply with specified requirements.
 - 3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

- d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 - e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- 2. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
- C. Prepare test and inspection reports.

3.5 EXTERIOR JOINT SEALANT SCHEDULE

- A. Concealed transitions in air barrier
 - 1. Specified Joint Sealant: NSJS#01.
 - 2. Alternate Joint Sealants: UJS#01.
 - 3. Joint Sealant Color: As selected by Architect from Manufacturer's full range.
- B. Exterior joints within exterior insulation finish systems (EIFS).
 - 1. Specified Joint Sealant: NSJS#01.
 - 2. Alternate Joint Sealants: SJS#01, NSJS#03, NSJS#04, UJS#02, IJS#03.
 - 3. Joint Sealant Color: As selected by Architect from Manufacturer's full range.
- C. Exterior joints between different materials listed above:
 - 1. Specified Joint Sealant: NSJS#01.
 - 2. Alternate Joint Sealants: SJS#01, SJS#02, SJS#04, NSJS#02, NSJS#04, UJS#01, UJS#02.
 - 3. Joint Sealant Color: As selected by Architect from Manufacturer's full range.
 - a. Multiple colors may be required to match several conditions.
- D. Exterior perimeter joints at frames of windows, storefront frames:
 - 1. Specified Joint Sealant: NSJS#01.
 - 2. Alternate Joint Sealants: SJS#01, SJS#02, SJS#04, NSJS#02, NSJS#04, UJS#01, UJS#02.
 - 3. Joint Sealant Color: As selected by Architect from Manufacturer's full range.
 - a. Multiple colors may be required to match several conditions.

- E. Exterior joints within aluminum storefront framing:
 - 1. Specified Joint Sealant: NSJS#01.
 - 2. Alternate Joint Sealants: SJS#01, SJS#02, SJS#04, NSJS#02.
 - 3. Joint Sealant Color: As selected by Architect from manufacturer's full range.
- F. Exterior non-traffic joints not otherwise noted:
 - 1. Specified Joint Sealant: NSJS#01.
 - 2. Alternate Joint Sealants: SJS#01, NSJS#02, NSJS#04, UJS#01, UJS#02.
 - 3. Joint Sealant Color: As selected by Architect from manufacturer's full range.
 - a. Multiple colors may be required to match several conditions.

3.6 INTERIOR JOINT SEALANT SCHEDULE

- A. Interior perimeter joints of exterior aluminum frames:
 - 1. Specified Joint Sealant: UJS#02.
 - 2. Joint Sealant Color: As selected by Architect from manufacturer's full range.
- B. Perimeter joints of interior frames:
 - 1. Specified Joint Sealant: LJS#01.
 - 2. Alternate Joint Sealants: SJS#04, UJS#02
 - 3. Joint Sealant Color: As selected by Architect from manufacturer's full range.
 - a. Multiple colors may be required to match several conditions.
- C. Sanitary joints between plumbing fixtures and walls, floors and casework:
 - 1. Joint Sealant: MRJS#01
 - 2. Joint Sealant Color: As selected by Architect from manufacturer's full range.
- D. Interior traffic joints in floors and between floor and wall construction:
 - 1. Specified Joint Sealant (gunnable): SJS#01.
 - 2. Alternate Joint Sealants (pourable): IJS#01, IJS#02.
 - 3. Joint Sealant Color: As selected by Architect from manufacturer's full range.
 - a. Multiple colors may be required to match several conditions.
- E. Interior non-moving joints at between painted surfaces and other materials:
 - 1. Specified Joint Sealant: LJS#01.
 - 2. Alternate Joint Sealants: UJS#01.
 - 3. Joint Sealant Color: As selected by Architect from manufacturer's full range.
- F. Interior concealed sealants at thresholds and sills:

1. Joint Sealant: BJS#01.
2. Joint Sealant Color: As selected by Architect from manufacturer's full range.

3.7 CLEANING

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

3.8 PROTECTION

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

END OF SECTION 079200

SECTION 081216 - ALUMINUM FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior aluminum doors, door frames, and glazing frames.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Interior aluminum doors, door frames, and glazing frames.

B. Product Data Submittals: For each product.

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

C. Shop Drawings: For aluminum frames:

1. Include elevations, sections, and installation details for each wall-opening condition.
2. Include details for each frame type, including dimensioned profiles and metal thicknesses.
3. Include locations of reinforcements and preparations for hardware.
4. Include details of anchorages, joints, field splices, connections, and accessories.
5. Include details of moldings, removable stops, and glazing.

D. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard sizes.

E. Product Schedule: For aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data:** For aluminum frames to include in maintenance manuals.

ALUMINUM FRAMES

081216 - 1

PART 2 - PRODUCTS

2.1 ALUMINUM FRAMES

- A. Source Limitations: Obtain aluminum frames and frame-manufacturer's doors from single source from single manufacturer.

2.2 INTERIOR ALUMINUM DOORS, DOOR FRAMES, AND GLAZING FRAMES

- A. Aluminum Framing: ASTM B221 (ASTM B221M), with alloy and temper required to suit structural and finish requirements, and not less than 0.062 inch (1.6 mm) thick.
- B. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.
- C. Glazing Frames: Extruded aluminum, for indicated glass thickness.
- D. Trim: Extruded aluminum, not less than 0.062 inch (1.6 mm) thick; removable, snap-in casing trim, glazing stops and door stops, without exposed fasteners.
- E. Doors:
 - 1. Manufacturer's standard, factory-assembled, 1-3/4-inch- (45-mm-) thick, aluminum-framed door construction.
 - a. Swinging.

2.3 ACCESSORIES

- A. Fasteners: Aluminum, nonmagnetic, stainless steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.
- B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals in black color.
- C. Glazing Gaskets: Manufacturer's standard extruded or molded rubber or plastic, to accommodate glazing thickness indicated; in black.
- D. Glass: As specified in Section 088000 "Glazing."
- E. Door Hardware: As specified in Section 087100 "Door Hardware."

2.4 FABRICATION

- A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted and mitered connections.

ALUMINUM FRAMES

081216 - 2

- B. Factory prepare aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Section 087100 "Door Hardware."
 - 1. Locate hardware cutouts and reinforcements as required by fire-rated label for assembly.
- C. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.
 - 1. Locate removable stops on the inside of spaces accessed by keyed doors.
- D. Fabricate components to allow secure installation without exposed fasteners.

2.5 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify that wall thickness does not exceed standard tolerances allowed by throat size of indicated aluminum frame.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install aluminum frames plumb, rigid, properly aligned, and securely fastened in place; according to manufacturer's written instructions.
- B. Install frame components in the longest possible lengths with no piece less than 48 inches (1220 mm); components 96 inches (2450 mm) or shorter must be one piece.
 - 1. Fasten to suspended ceiling grid on maximum 48-inch (1220-mm) centers, using sheet metal screws or other fasteners approved by frame manufacturer.

ALUMINUM FRAMES

081216 - 3

2. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
 3. Secure clips to extruded main-frame components and not to snap-in or trim members.
 4. Do not leave screws or other fasteners exposed to view when installation is complete.
- C. Glass: Install glass according to Section 088000 "Glazing" and aluminum-frame manufacturer's written instructions.

3.3 ADJUSTING

- A. Inspect installation, correct misalignments, and tighten loose connections.
- B. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended in writing by frame manufacturer and according to AAMA 609 and AAMA 610.
- C. Touch Up: Repair marred frame surfaces to blend inconspicuously with adjacent unrepaired surface so touchup is not visible from a distance of 48 inches (1220 mm) as viewed by Architect. Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END OF SECTION 081216

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Five-ply flush wood veneer-faced doors for transparent finish.
 - 2. Ballistic-rated wood veneer-faced doors for transparent finish.
 - 3. Factory finishing flush wood doors.
 - 4. Factory fitting flush wood doors to frames and factory machining for hardware.

- B. Related Requirements:

- 1. Section 064023 "Interior Architectural Woodwork" for wood door frames.
 - 2. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:

- 1. Door core materials and construction.
 - 2. Door edge construction.
 - 3. Door face type and characteristics.
 - 4. Door trim for openings.
 - 5. Factory-machining criteria.
 - 6. Factory- finishing specifications.

- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

- 1. Door schedule indicating door location, type, size, fire protection rating, and swing.
 - 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
 - 3. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 4. Dimensions and locations of blocking for hardware attachment.

5. Dimensions and locations of mortises and holes for hardware.
6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Doors to be factory finished and application requirements.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
3. Louver blade and frame sections, 6 inches long, for each material and finish specified.
4. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

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

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: Comply with current edition of AWI/AWMAC/WT's "Architectural Woodwork Standards."
- B. Adhesives: Do not use adhesives that contain urea formaldehyde.
- C. Adhesives: Use adhesives that meet the testing and product requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Composite Wood Products: Products shall be made without urea formaldehyde.
- E. Composite Wood Products: Products shall comply with the testing and product requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Doors:
 - 1. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the work include but are not limited to the following:
 - a. Eggers Industries.
 - b. Lambton Doors.

FLUSH WOOD DOORS

081416 - 3

- c. Masonite Architectural.
 - d. Oshkosh Door Company.
 - e. VT Industries Inc.
2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty unless indicated otherwise.
 - a. ANSI/WDMA I.S. 1A Heavy Duty at private offices.
 3. Architectural Woodwork Standards or ANSI/WDMA I.S. 1A Grade: Premium.
 4. Faces: Single-ply wood veneer not less than 1/50 inch thick.
 - a. Species: match existing.
 - b. Cut: Quarter sliced.
 - c. Match between Veneer Leaves: Book match.
 - d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
 - e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 - f. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
 - g. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
 - h. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Section 064216 "Flush Wood Paneling."
 5. Exposed Vertical and Top Edges: Same species as faces - Architectural Woodwork Standards edge Type A.
 6. Core for Non-Fire-Rated Doors:
 - a. ANSI A208.1, Grade LD-2 particleboard.
 - 1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - 2) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087111 "Door Hardware (Descriptive Specification."
 - b. Glued wood stave.
 - c. WDMA I.S. 10 structural composite lumber.
 - 1) Screw Withdrawal, Door Face: 550 lbf.
 - 2) Screw Withdrawal, Vertical Door Edge: 400 lbf.
 7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

B. Ballistic-Rated Solid-Core Doors:

1. General: Comply with requirements for veneer faced wood doors and the following:
 - a. UL752: Level 3.
2. Manufacturers: Insulgard LC door System or approved equal.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.5 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Premium.
2. Finish: ANSI/WDMA I.S. 1A TR-6 Catalyzed Polyurethane.
3. Staining: Match Architect's sample.

FLUSH WOOD DOORS

081416 - 5

4. Effect: Filled finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087111 "Door Hardware (Descriptive Specification)."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Job-Fitted Doors:
 1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
 - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
 2. Machine doors for hardware.
 3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 4. Clearances:
 - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
 - b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
 - c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - d. Comply with NFPA 80 for fire-rated doors.
 5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
 6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

D. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 084126 "All-Glass Entrances and Storefronts."

1.2 DEFINITIONS

- A. Glass Manufacturers:** Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses:** Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC:** International Building Code.
- D. Interspace:** Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.**

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturers of fabricated glass units.
- B. Product Certificates: For glass.
- C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.
- B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

- C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
- D. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" and 084423 - Structural-Sealant-Glazed Curtain Walls" to match glazing systems required for Project, including glazing methods.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- D. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: As indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - 2. Design Snow Loads: As indicated on Drawings.
 - 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.

4. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
 4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
 5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Low-Iron Annealed Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent.
- C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- E. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 - 2. Perimeter Spacer: Aluminum with black, color anodic finish.
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Pecora Corporation

2. Sika Corporation - Building Components.
3. The Dow Chemical Company.
4. Tremco Incorporated

C. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.

1. DOWSIL 790 Silicone Building Sealant or approved equivalent

D. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

1. DOWSIL 791 Silicone Weatherproofing Sealant or approved equivalent

E. Neutral-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.

1. DOWSIL 999A Silicone Building & Glazing Sealant or approved equivalent

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. EPDM with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

GLAZING

088000 - 7

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 2. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
1. EPDM with Shore A durometer hardness per manufacturer's written instructions.
 2. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.
- I. Install gaskets so they protrude past face of glazing stops.

3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.7 MONOLITHIC GLASS SCHEDULE

- A. Clear Glass Type “A-F”: Heat-strengthened float glass.
 - 1. Minimum Thickness: 1/4" (6mm).
- B. Clear Glass Type “A-T”: Fully tempered float glass.
 - 1. Minimum Thickness: 1/4" (6mm).
 - 2. Safety glazing required.
- C. Clear Glass Type “B-T”: Fully tempered float glass.
 - 1. Minimum Thickness: 1/2" (12mm).
 - 2. Safety glazing required.
- D. Clear Glass Type “C-T”: Fully tempered float glass.
 - 1. Minimum Thickness: 5/8" (16mm).
 - 2. Safety glazing required.
- E. Clear Glass Type “D-T”: Fully tempered float glass.
 - 1. Minimum Thickness: 3/4" (19mm).
 - 2. Safety glazing required.

3.8 INSULATING GLASS SCHEDULE

- A. Low-E-Coated, Clear Insulating Glass Type “F-F”:

GLAZING

088000 - 11

1. Basis-of-Design Product: Viracon; VRE1-4725.
2. Overall Unit Thickness: 1-1/16 inch.
3. Outdoor Lite: 5/16" (8mm) Clear with VRE-4725 low-e coating on #2 surface heat-strengthened float glass.
4. Interspace Content: 1/2" (13.2mm) Argon filled.
5. Indoor Lite: 1/4" (6mm) Clear heat-strengthened float glass.
6. Winter Nighttime U-Factor: 0.25 maximum.
7. Summer Daytime U-Factor: 0.21 maximum.
8. Visible Light Transmittance: 47 percent minimum.
9. Shading Coefficient: 0.28 minimum.
10. Exterior reflectivity: 25 percent.
11. Solar Heat Gain Coefficient: 0.25 maximum.

B. Low-E-Coated, Clear Insulating Glass Type "F-T":

1. Basis-of-Design Product: Viracon; VRE1-4725.
2. Overall Unit Thickness: 1-1/16 inch.
3. Outdoor Lite: 5/16" (8mm) Clear with VRE-4725 low-e coating on #2 surface fully-tempered float glass.
4. Interspace Content: 1/2" (13.2mm) Argon filled.
5. Indoor Lite: 1/4" (6mm) Clear fully-tempered float glass.
6. Winter Nighttime U-Factor: 0.25 maximum.
7. Summer Daytime U-Factor: 0.21 maximum.
8. Visible Light Transmittance: 47 percent minimum.
9. Shading Coefficient: 0.28 minimum.
10. Exterior reflectivity: 25 percent.
11. Solar Heat Gain Coefficient: 0.25 maximum.
12. Safety Glazing Required.

C. Low-E-Coated, Low-Iron Insulating Glass Type "G-F":

1. Basis-of-Design Product: Viracon; VE31-2M.
2. Overall Unit Thickness: 1-1/16 inch.
3. Outdoor Lite: 5/16" (8mm) UltraClear with VE-2M low-e coating on #2 surface heat-strengthened float glass.
4. Interspace Content: 1/2" (13.2mm) Argon filled.
5. Indoor Lite: 1/4" UltraClear heat-strengthened float glass.
6. Winter Nighttime U-Factor: 0.25 maximum.
7. Summer Daytime U-Factor: 0.21 maximum.
8. Visible Light Transmittance: 75 percent minimum.
9. Shading Coefficient: 0.46 minimum.
10. Solar Heat Gain Coefficient: 0.40 maximum.

D. Low-E-Coated, Low-Iron Insulating Glass Type "G-T":

1. Basis-of-Design Product: Viracon; VE31-2M.
2. Overall Unit Thickness: 1-1/16 inch.
3. Outdoor Lite: 5/16" (8mm) UltraClear with VE-2M low-e coating on #2 surface fully-tempered float glass.

4. Interspace Content: 1/2" (13.2mm) Argon filled.
5. Indoor Lite: 1/4" UltraClear fully-tempered float glass.
6. Winter Nighttime U-Factor: 0.25 maximum.
7. Summer Daytime U-Factor: 0.21 maximum.
8. Visible Light Transmittance: 75 percent minimum.
9. Shading Coefficient: 0.46 minimum.
10. Solar Heat Gain Coefficient: 0.40 maximum.
11. Safety Glazing Required.

END OF SECTION 088000

SECTION 088853 - SECURITY GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Security glazing.
 - 2. Insulating security glazing.

1.3 DEFINITIONS

- A. Glazing Manufacturers: Firms that produce primary glass, monolithic plastic glazing, or fabricated security glazing, as defined in referenced glazing publications.
- B. Interspace: Space between lites of air-gap security glazing or insulating security glazing.

1.4 COORDINATION

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

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for security glazing during and after installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Security Glazing Samples: For each type of security glazing; 12 inches square.
- C. Glazing Accessory Samples: For sealants, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers glazing testing agency and sealant testing agency.
- B. Product Certificates: For each type of product indicated, from manufacturer.
- C. Product Test Reports: For each type of security glazing, for tests performed by a qualified testing agency.
- D. Product Test Reports: For each type of glazing sealant, for tests performed by a qualified testing agency.
 - 1. Provide test reports based on testing current sealant formulations within previous 36-month period.
- E. Preconstruction adhesion and compatibility test reports.
- F. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating Security Glazing Units with Sputter-Coated, Low-E Coatings: A qualified insulating glazing manufacturer who is approved by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glazing installers for this Project who are certified under the National Glass Association Glazier Certification Program.
- C. Security Glazing Testing Agency Qualifications: Subject to compliance with requirements, testing agency is one of the following:
 - 1. H. P. White Laboratory, Inc.
 - 2. Underwriters Laboratories, Inc.
 - 3. Wiss, Janney, Elstner Associates, Inc.
- D. Sealant Testing Agency Qualifications: Qualified according to ASTM C1021 for testing indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect security glazing and glazing materials according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating security glazing and with air-gap security glazing manufacturers' written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Polycarbonate Sheet: Manufacturer agrees to replace polycarbonate sheet that deteriorates within specified warranty period. Deterioration of polycarbonate sheet is defined as defects developed from normal use that are not attributed to maintaining and cleaning polycarbonate sheet contrary to manufacturer's written instructions. Defects include yellowing and loss of light transmission.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Security Glazing: Obtain security glazing from single source from single manufacturer using the same types of lites, plies, interlayers, and spacers for each security glazing type indicated.
- B. Source Limitations for Glazing Sealants and Gaskets: Obtain from single source from single manufacturer for each product and installation method.
 - 1. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.2 POLYCARBONATE SECURITY GLAZING

- A. Insulgard SP1250 or approved equal.

2.3 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and security glazing manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Verify sealant has a VOC content of 250 g/L or less.
 4. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.
 - b. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - c. Pecora Corporation.
 - d. Sika Corporation.
 - e. The Dow Chemical Company.
 - f. Tremco Incorporated.

2.4 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of security glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain security glazing lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit security glazing lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.5 FABRICATION OF SECURITY GLAZING

- A. Fabricate security glazing in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Grind smooth and polish exposed security glazing edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing for security glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Minimum required bite.
 - 5. Effective sealing between joints of framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and appearance.

- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
 - D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
 - E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.
 - F. Provide spacers for security glazing lites where the length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
 - G. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and according to requirements in referenced glazing publications.
 - H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.
 - I. Set coated security glazing with proper orientation so that coatings and films face exterior or interior as specified.
 - J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
 - K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.
- 3.4 TAPE GLAZING
- A. Position tapes on fixed stops so that, when compressed by security glazing, their exposed edges are flush with or protrude slightly above sightline of stops.
 - B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
 - C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center security glazing in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket securely in place between glazing unit and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center security glazing in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center security glazing in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to security glazing and channel surfaces.

- C. Tool exposed surfaces of sealants to provide a substantial wash-away from security glazing.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.
- C. Wash security glazing on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

END OF SECTION 088853

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior partitions.
- B. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Horizontal Deflection: For wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 5 lbf/sq. ft.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

- B. Studs and Runners: ASTM C 645.
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
- C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 0.0329 inch.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

NON-STRUCTURAL METAL FRAMING

092216 - 2

- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
- B. Install studs so flanges within framing system point in same direction.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Interior gypsum board.
 - 2. Bullet-Resistant composite panels.
 - 3. Sound-attenuation blankets.

- B. Related Requirements:

- 1. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Gypsum board, Type X.
 - 2. Gypsum ceiling board.
 - 3. Impact-resistant gypsum board.
 - 4. Interior trim.
 - 5. Aluminum trim.
 - 6. Joint treatment materials.
 - 7. Laminating adhesive.
 - 8. Sound-attenuation blankets.

1.4 DELIVERY, STORAGE AND HANDLING

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

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Ceiling and wall material shall comply with the California Department of Health's "Standard Method for Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 GYPSUM BOARD, GENERAL

- A. Recycled Content: Post-consumer recycled content plus ½ of pre-consumer recycled content not less than 25%.
- B. Regional Materials: As possible, products shall be manufactured within 500 miles of project site from materials that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of project site.
- C. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
 - 1. Thickness: 5/8 inch.

GYPSUM BOARD

092900 - 2

2. Long Edges: Tapered.

B. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

2.4 BULLET-RESISTANT COMPOSITE PANELS

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

1. Waco Composites, Ltd., Armor-Core.
2. Pacific Bullet Proof Co.; PBBRF3.
3. Protective Structures, Ltd, Secure All.
4. Armortex Inc., Armortex O.F.

B. Protection Level: UL752, Level 3.

C. Fire Rating: ASTM E119, One-hour.

D. Panel Size: 4 feet by 8 feet.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated in drawings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich.
 - b. Flannery, Inc.
 - c. Fry Reglet Corporation.
 - d. Gordon, Inc.
 - e. Pittcon Industries.
 - f. Tamlyn.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
3. Size and Profile: As Indicated on Drawings.
4. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
 1. Interior Gypsum Board: Paper.
 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 3. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound, drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.7 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 1. Adhesives shall have a VOC content of 50 g/L or less.
 2. Adhesives shall comply with the California Department of Health's "Standard Method for Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

GYPSUM BOARD

092900 - 4

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- F. Acoustical Sealant: As specified in Section 079219 "Acoustical Sealant."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.

2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
1. Wallboard Type: As indicated on Drawings.
 2. Type X: Vertical surfaces unless otherwise indicated.
 3. Ceiling Type: Ceiling surfaces.
 4. Impact-Resistant Type: As indicated on Drawings.
 5. Mold-Resistant Type: As indicated on Drawings.
 6. Glass-Mat Interior Type: At tiled locations and as indicated on Drawings.
- B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly or bullet-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

- b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
- 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
 - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - 3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - 4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings, according to ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use where indicated.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile and acoustical tile.
 - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Modular carpet tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Shop Drawings: For carpet tile installation, plans showing the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.
 - 8. Type, color, and location of insets and borders.
 - 9. Type, color, and location of edge, transition, and other accessory strips.
 - 10. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.
- D. Samples for Initial Selection: For each type of carpet tile.

1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.
- E. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 1. Carpet Tile: Full-size Sample.
 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.
- F. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- G. Sustainable Product Certification: Provide ANSI/NSF 140 certification for carpet products.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Master II certification level.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard."

1.9. FIELD CONDITIONS

- A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE – CP1

- A. Manufacturers: Milliken Ghost Artist or approved equal.

- B. Color: To be selected by owner
- C. Pattern: To be selected by owner
- D. Size: 24in x 24in
- E. Applied Treatments:
 - 1. Soil-Resistance Treatment: Manufacturer's standard treatment.
 - 2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:
 - a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8-inch-wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.
- I. Access Flooring: Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Steel.
 - 2. Wood.
 - 3. Gypsum board.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming structural steel.
 - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523, a matte flat finish.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. VOC content.

1.5 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer's label with the following information:
 - 1. Product name and type (description).
 - 2. Batch date.
 - 3. Color number.
 - 4. VOC content.
 - 5. Environmental handling requirements.
 - 6. Surface preparation requirements.
 - 7. Application instructions.

- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company products indicated or comparable product from one of the following:
 - 1. Benjamin Moore & Co.
 - 2. Sherwin-Williams Company (The).
 - 3. Dunn-Edwards.
- B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
 - 1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 PAINT, GENERAL

- A. Standards: Provide products that comply with Manufacturer's Premium 1st Quality standards indicated and like VOC limits.
- B. 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, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Colors: As indicated in finish schedule.

INTERIOR PAINTING

099123 - 3

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
 - 1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Substrate Conditions:
 - 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Wood: 15 percent.
 - b. Gypsum Board: 12 percent.
 - 2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" 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 if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

INTERIOR PAINTING

099123 - 4

- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
 - 1. SSPC-SP 3, "Power Tool Cleaning".
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Aluminum Substrates: Remove loose surface oxidation.
- H. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- I. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. 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.

INTERIOR PAINTING

099123 - 5

- E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Tanks that do not have factory-applied final finishes.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - f. Other items as directed by Architect.
 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 3. Allow empty paint cans to dry before disposal.
 4. Collect waste paint by type and deliver to recycling or collection facility.

INTERIOR PAINTING

099123 - 6

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

3.6 INTERIOR PAINTING SCHEDULE

A. Metal Substrates (Aluminum, Steel):

1. Alkyd System:

- a. Prime Coat: Primer, rust-inhibitive, water based: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310, at 5.0 to 10.0 mils wet, 2.0 to 4.0 mils dry.
- b. Intermediate Coat: Alkyd, interior, matching topcoat.
- c. Topcoat: Alkyd, semi-gloss, interior: S-W ProClassic Alkyd Semi-Gloss, B34-51 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

2. Acrylic/Alkyd System:

- a. Prime Coat: Prime Coat: Primer, rust-inhibitive, water based: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310, at 5.0 to 10.0 mils wet, 2.0 to 4.0 mils dry.
- b. Intermediate Coat: Water-based acrylic-alkyd, interior, matching topcoat.
- c. Topcoat: Water-based acrylic-alkyd, semi-gloss, interior: S-W ProMar 200 Waterbased Acrylic-Alkyd Semi-Gloss, B34-8200 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

B. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.

1. Alkyd System:

- a. Prime Coat: Primer sealer, latex, interior: S-W Premium Wall & Wood Primer, B28W8111, at 4.0 mils wet, 1.8 mils dry.
- b. Intermediate Coat: Alkyd, interior, matching topcoat.
- c. Topcoat: Alkyd, semi-gloss, interior: S-W ProClassic Alkyd Semi-Gloss, B34-51 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

2. Acrylic/Alkyd System:

- a. Prime Coat: Primer sealer, latex, interior: S-W Premium Wall & Wood Primer, B28W8111, at 4.0 mils wet, 1.8 mils dry.

- b. Intermediate Coat: Water-based acrylic-alkyd, interior, matching topcoat.
- c. Topcoat: Water-based acrylic-alkyd, semi-gloss, interior: S-W ProMar 200 Waterbased Acrylic-Alkyd Semi-Gloss, B34-8200 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

C. Gypsum Board Walls Substrates:

1. Latex System:

- a. Prime Coat: Primer, latex, interior: S-W High Hold Out Primer, B28WY2000, at 4.0 mils wet, 1.5 mils dry.
- b. Intermediate Coat: Latex, interior, matching topcoat.
- c. Topcoat: Latex, interior, eggshell, (Gloss Level 3): S-W Cashmere Interior Acrylic Low Lustre, D17W151, at 4.0 mils wet, 1.7 mils dry, per coat.

2. Gypsum Board Ceilings:

- a. Prime Coat: Primer sealer, latex, interior: S-W High Hold Out Primer, B28WY2000, at 4.0 mils wet, 1.5 mils dry.
- a. Intermediate Coat: Latex, interior, matching topcoat.
- b. Topcoat: Latex, interior, flat, (Gloss Level 1): S-W ProMar 400 Zero VOC Interior Latex Flat, B30W4651, at 4.0 mils wet, 1.6 mils dry, per coat.

END OF SECTION 099123

SECTION 220523 - VALVES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes valves for building services piping.

1.2 REFERENCES

- A. AGA Z21.22 (American Gas Association) - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.
- B. ASME B16.3 (American Society of Mechanical Engineers) - Malleable Iron Threaded Fittings.
- C. AWS (American Welding Society) - Welding and Brazing Qualifications.
- D. MSS SP-67 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Butterfly Valves.
- E. MSS SP-71 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
- F. MSS SP-78 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Plug Valves, Flanged and Threaded Ends.
- G. MSS SP-80 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Bronze Gate, Globe, Angle and Check Valves.
- H. MSS SP-85 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.
- I. MSS SP-110 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

- A. Submit product data in accordance with the General Conditions of the Contract.
- B. Product Data: Submit Manufacturers catalog information with valve data and ratings for each service.
- C. Welders Certificate: Include welders certification of compliance with ASME SEC IX., AWS D1.1.

VALVES

220523 - 1

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.

PART 2 PRODUCTS

2.1 PLUMBING VALVES

2.2 BALL VALVES

- A. Construction, 4 inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends.

2.3 SWING CHECK VALVES

- A. Up To and Including 3 inches (80 mm):
 - 1. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder or threaded ends.
- B. 2 inches (50 mm) and Larger:
 - 1. MSS SP-71, Class 12, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

2.4 SPRING LOADED CHECK VALVES

- A. Construction: Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.5 WATER PRESSURE REDUCING VALVES

- A. Up to 2 inches (50 mm):

VALVES

220523 - 2

1. Construction: MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded ends.
- B. Over 2 inches (50 mm):
 1. Construction: MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.6 RELIEF VALVES

- A. Construction: AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Construction: AGA Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F (98.9 degrees C), capacity ASME SEC IV certified and labeled.

2.7 BALL VALVES

- A. Construction: Bronze, two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder or threaded ends.

2.8 SWING CHECK VALVES

- A. Construction: Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder or threaded ends.
- B. Over 2 inches (50 mm):
 1. Construction: Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

2.9 SPRING LOADED CHECK VALVES

- A. Construction: Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

2.10 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe 2 inches (50 mm) and Under:
 1. Ferrous Piping: 150 psig (1034 kPa) malleable iron, threaded.
 2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe Over 2 inches (50 mm):

VALVES

220523 - 3

1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.
 2. Copper Piping: Bronze.
- C. Gaskets: 1/16-inch (1.6 mm) thick preformed neoprene.
- D. Grooved and Shouldered Pipe End Couplings:
1. Housing Clamps: Malleable iron to engage and lock designed to permit some angular deflection, contraction, and expansion.
 2. Sealing Gasket: C-shape elastomer composition for operating temperature range from 30 degrees F to 230 degrees F.
- E. Accessories: Steel bolts, nuts, and washers.
- F. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, and water impervious isolation barrier.

2.19 TEMPERATURE-ACTUATED WATER MIXING VALVES

- A. Individual-Fixture, Water Tempering:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Powers; a Watts Industries Co.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
 2. Standard: ASSE 1070, thermostatically controlled water tempering valve.
 3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
 4. Body: Bronze body with corrosion-resistant interior components.
 5. Temperature Control: Adjustable.
 6. Inlets and Outlet: Threaded.
 7. Finish: Rough or chrome-plated bronze.
- B. TMV-1 Thermostatic Mixing Valve: Leonard TM-80 thermostatic mixing valve with 1" inlets, 1-1/4" outlet, cold water bypass with volume control/shutoff and cabinet.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify Piping System is ready for installation.

3.2 INSTALLATION

- A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Install valves with stems upright or horizontal, not inverted.
- C. Use grooved mechanical couplings and fasteners only in accessible locations.
- D. Install unions downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- E. Install ball or butterfly valves for shut-off and to isolate each piece of equipment, part of systems, or vertical risers.
- F. Install globe, ball or butterfly valves for throttling, bypass, or manual flow control services.
- G. Provide spring loaded check valves on discharge of water pumps.
- H. Provide plug valves in natural gas systems for shut-off service.
- I. Provide flow controls in water re-circulating systems as indicated on Drawings.
- J. Use lug end butterfly valves to isolate equipment.
- K. Use 3/4 inch (20 mm) ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- L. Provide check valve for backflow prevention.
- M. Provide access means for each valve. Coordinate access means with General Contractors.
- N. Provide isolation valve at each branch take-off serving two or more fixtures or items of equipment.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Conform to applicable piping specification for hangers and insulation.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pipe and equipment supports, hangers, anchors, bases sleeves and sealing of work to adjacent construction.

1.2 REFERENCES

- A. ASME B31.9 (American Society of Mechanical Engineers) - Building Services Piping.
- B. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- C. AWS D1.1 (American Welding Society) - Structural Welding Code.
- D. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- E. MSS SP69 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Selection and Application.
- F. MSS SP89 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.4 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. B-Line, Fee and Mason, Grinnell, PH.D and Michigan

B. General:

1. Hangers, and accessories shall be sized with a safety factor of five (5) times the actual load.
2. Hangers for insulated piping shall be oversized to accommodate insulation thickness. Provide with insulation shields with inserts or insulation saddles as required in Section 220700 – Mechanical Insulation.
3. Copper clad hangers shall be used for copper piping systems. Provide heavy density mildew and moisture rot proof felt pad securely attached to the hanger or 5 mil thick polyvinyl chloride coating to prevent contact between the pipe and hanger.

C. Plumbing Piping – DWV:

1. Conform to ASME B31.9 ASTM F708 MSS SP58 MSS SP69 MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches (50 mm) and Over: Hot Dipped Galvanized, Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Hot dipped galvanized, steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 inches (76 mm): Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches (100 mm) and Over: Welded hot dipped galvanized steel bracket and wrought hot dipped galvanized steel clamp.
7. Vertical Support: Hot dipped galvanized steel riser clamp.
8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated, Carbon-steel adjustable, ring.

D. Plumbing Piping – Water:

1. Conform to ASME B31.9 ASTM F708 MSS SP 58 MSS SP69 MSS SP89.
2. Hangers Pipe Sizes ½ to 1-1/2 inch (13 to 38 mm): Hot dipped galvanized, carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches (50 mm) and Over: Hot dipped galvanized, carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 inches (50 to 100 mm): Hot dipped galvanized, carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 inches (150 mm) and Over: Adjustable, Hot dipped galvanized, steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Hot dipped galvanized, steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches (150 mm) and Over: Hot dipped galvanized, steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall support for pipe sizes to 3 inches (76 mm): Cast iron hook.
9. Wall support for pipe sizes 4 inches (100 mm) and Over: Welded, hot dipped galvanized, steel bracket and wrought hot dipped galvanized steel clamp.

10. Wall support for hot pipe sizes 6 inches (150 mm) and Over: Welded hot dipped galvanized, steel bracket and wrought hot dipped galvanized, steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Hot dipped galvanized, steel riser clamp.
12. Floor support for cold pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor support for hot pipe sizes to 4 inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor support for hot pipe sizes 6 inches (150 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or hot dipped galvanized steel support.
15. Copper Pipe Support: Copper-plated, Hot Dipped Galvanized, Carbon-steel ring.

2.2 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

- A. Metal Flashing: 26 gage galvanized steel.
- B. Metal Counterflashing: 22 gage galvanized steel.
- C. Lead Flashing:
 1. Waterproofing: 5 lb./sq. ft (24.5 kg/sq m) sheet lead
 2. Soundproofing: 1 lb./sq. ft (5 kg/sq m) sheet lead.
- D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- E. Caps: Steel, 22 gage (0.8 mm) minimum; 16 gage (1.5 mm) at fire resistant elements.

2.5 EQUIPMENT CURBS

- A. Fabrication: Welded 18 gage (1.2 mm) galvanized steel shell and base, mitered 3 inch cant, variable step to match roof insulation, 1-1/2 inch thick insulation, factory installed wood nailer.

2.6 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage (1.2 mm) thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed Sleeves for Round Ductwork: Galvanized steel.
- D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.
- E. Fire-Stopping Insulation: Glass fiber type, non-combustible.

PART 3 EXECUTION

INSTALLATION:

3.1 INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.2 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers with minimum 1/2-inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.

HANGERS AND SUPPORTS

220529 -4

- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide copper plated hangers and supports for copper piping.
- J. Design hangers for pipe movement without disengagement of supported pipe.

3.3 EQUIPMENT BASES AND SUPPORTS

- A. Provide reinforced concrete housekeeping pads, minimum 4 thick and extending 6 inches (150 mm) beyond supported equipment. Refer to Architectural Concrete Specifications.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of Steel pipe and fittings. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.4 FLASHING

- A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches (75 mm) minimum above finished roof surface with lead worked 1 inch (25 mm) minimum into hub, 8 inches (200 mm) minimum clear on sides with 24 x 24 inches (600 x 600 mm) sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches (250 mm) clear on sides with minimum 36 x 36 inch (910 x 910 mm) sheet size. Fasten flashing to drain clamp device.
- D. Seal floor drains watertight to adjacent materials.
- E. Provide acoustical sound control around ducts and pipes penetrating equipment rooms. Fill openings with fiberglass blanket and caulk each side of opening with non-hardening caulking compound.

- F. Provide curbs for mechanical roof installations 14 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.
- G. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.5 SLEEVES

- A. Set sleeves in position in forms. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- C. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- E. Install chrome plated steel escutcheons at finished surfaces.

3.6 SCHEDULES

- A. Install pipe hangers in accordance to IPC Section 308.

END OF SECTION 220529

SECTION 220548 - MECHANICAL SOUND, VIBRATION, AND SEISMIC CONTROL

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes vibration isolation. Seismic anchorage for all isolated and non-isolated equipment, ductwork and piping systems furnished and installed under Division 15.
- B. Related Sections:
 - 1. Section 220529 – Hangers and Supports
 - 2. Section 232116 – Piping Specialties: Product requirements for Supports, anchors and piping expansion compensation for placement by this section.
 - 3. Section 233100 – Ducts
 - 4. Section 233300 – Duct Accessories: Product requirements for both solid and flexible duct connectors for duct silencers specified for placement by this section.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide seismic anchorage and bracing for all equipment, ductwork and piping in accordance with the 2021 International Building Code.
 - 1. Supports, anchorage and bracing of all equipment, piping and ductwork, shall be designed by a professional engineer working for the restraint manufacturer and qualified with experiences in the seismic bracing of mechanical systems. The seismic engineer shall establish anchorage requirement specific to the equipment submitted, reviewed and accepted by the Architect/Engineer for the project.
 - 2. Furnished equipment shall meet the requirements of the seismic codes with bases and supports designed to accommodate seismic support.
 - 3. Prior to starting mechanical work, contractor is to submit to mechanical engineer seismic details and drawings by a licensed seismic engineer for all equipment requiring seismic restraint. These drawings are to be stamped and signed, and will then be reviewed with engineer and city.
 - 4. Upon completion of the project, the licensing seismic engineer shall perform a walk through of the project site and submit a written observation report to the mechanical engineer and to the city. Contractor shall notify engineer and the city when seismic engineer is to perform site visit.
- B. Provide vibration isolation on motor driven equipment over 0.5 hp (0.35 kW), plus connected piping and ductwork.
- C. Provide minimum static deflection of isolators for equipment as follows:
 - 1. Slab on Grade, Under 20 hp (15 kW)

- a. Under 400 rpm: Rubber Floor Isolator or Hanger
- b. 400 – 600 rpm: 1 inch (25 mm)
- c. 600 - 800 rpm: 0.5 inch (12 mm)
- d. 800 - 900 rpm: 0.2 inch (5 mm)
- e. 1100 - 1500 rpm: 0.14 inch (4 mm)
- f. Over 1500 rpm: 0.1 inch (3 mm)

2. Slab on Grade, Over 20 hp (15 kW)

- a. Under 400 rpm: Rubber Floor Isolators or Hangers
- b. 400 - 600 rpm: 2 inch (50 mm)
- c. 600 - 800 rpm: 1 inch (25 mm)
- d. 800 - 900 rpm: 0.5 inch (12 mm)
- e. 1100 - 1500 rpm: 0.2 inch (5 mm)
- f. Over 1500 rpm: 0.15 inch (4 mm)

3. Upper Floors, Normal

- a. Under 400 rpm: Rubber Floor Isolators or Hangers
- b. 400 - 600 rpm: 3.5 inch (90 mm)
- c. 600 - 800 rpm: 2 inch (50 mm)
- d. 800 - 900 rpm: 1 inch (25 mm)
- e. 1100 - 1500 rpm: 0.5 inch (12 mm)
- f. Over 1500 rpm: 0.2 inch (5 mm)

D. Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.

E. Maintain rooms at following maximum sound levels, in Noise Criteria (NC) as defined by ASHRAE Handbook.

1.3 SUBMITTALS

- A. Submit shop drawings calculations and product data in accordance with the general provisions of the specifications.
- B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, materials, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.
- C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials and dimensional data.
- D. Design Data: Submit calculations for seismic and vibration requirements for all equipment to be restrained and isolated. Drawings and calculations submitted for seismic bracing and anchors shall bear the engineer's signed professional seal.

- E. Prior to starting mechanical work, contractor is to submit to mechanical engineer seismic details and drawings by a licensed seismic engineer for all equipment requiring seismic restraint. These drawings are to be stamped and signed, and will then be reviewed with engineer and city.
- F. Upon completion of the project, mechanical contractor is to have the licensing seismic engineer perform a walk through of the project site and submit a written observation report to the mechanical engineer and to the city. Contractor shall notify engineer and the city when seismic engineer is to perform site visit.
- G. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.
- H. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.
- I. Manufacturer's Field Reports: Indicate sound isolation and seismic restraint installation is complete and in accordance with instructions.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with International Building Code (IBC), Smacna Seismic Restraint Manual, AMCA 300 ANSI S1.13 ARI 575 ASA 16 ANSI S1.36 standards and recommendations of ASHRAE 68.
- B. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.
- C. Design application of seismic restraint systems under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Utah.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATORS

A. Open Spring Isolators:

1. Spring Isolators:

- a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
- b. Code: Color code springs for load carrying capacity.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch (6 mm) thick neoprene sound pads, and zinc chromate plated hardware.

4. Sound Pads: Size for minimum deflection of 0.05 inch (1.2 mm); meet requirements for neoprene pad isolators.

B. Restrained Spring Isolators:

1. Spring Isolators:

- a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
- b. Code: Color code springs for load carrying capacity.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch (6 mm) thick neoprene sound pads, and zinc chromate plated hardware.

4. Sound Pads: Size for minimum deflection of 0.05 inch (1.2 mm); meet requirements for neoprene pad isolators.

5. Restraint: Furnish mounting frame and limit stops.

C. Closed Spring Isolators:

1. Spring Isolators:

- a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
- b. Code: Color code springs for load carrying capacity.

2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.

3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch (7 mm) clearance.
- D. Restrained Closed Spring Isolators:
1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch (7 mm) clearance and limit stops.
- E. Spring Hanger:
1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 3. Housings: Incorporate rubber hanger with threaded insert.
 4. Misalignment: Capable of 20 degree hanger rod misalignment.
- F. Neoprene Pad Isolators:
1. Rubber or neoprene-waffle pads.
 - a. 30 durometer.
 - b. Minimum 1/2 inch (13 mm) thick.
 - c. Maximum loading 40 psi (275 kPa).
 - d. Height of ribs: not to exceed 0.7 times width.
 2. Configuration: 1/2-inch (13 mm) thick waffle pads bonded each side of 1/4-inch (6 mm) thick steel plate.
- G. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches (13 mm) deflection with threaded insert.
- H. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.

I. Seismic Snubbers:

1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
2. Neoprene Elements: Replaceable, minimum of 0.75 inch (18 mm) thick.
3. Capacity: 4 times load assigned to mount groupings at 0.4 inch (10 mm) deflection.
4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

PART 3 EXECUTION

EXAMINATION:

3.1 INSTALLATION

- A. Install isolation for motor driven equipment.
1. Bases:
 2. Set steel bases for 1-inch (25 mm) clearance between housekeeping pad and base.
 3. Set concrete inertia bases for 2-inch (50 mm) clearance between housekeeping pad and base.
 4. Adjust equipment level.
- B. Install spring hangers without binding.
- C. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- D. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- E. Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.05-inch (1.5 mm) maximum clearance. Provide other snubbers with clearance between 0.15 inch (4 mm) and 0.25 inch (7 mm).
- F. Support piping connections to isolated equipment resiliently as follows:
1. Up to 4 inch (100 mm) Diameter: First three points of support.
 2. 5 to 8 inch (125 to 200 mm) Diameter: First four points of support.
 3. 10 inch (250 mm) Diameter and Over: First six points of support.

4. Select three hangers closest to vibration source for minimum 1.0-inch (25 mm) static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0-inch (25 mm) static deflection or 1/2 static deflection of isolated equipment.
- G. Connect wiring to isolated equipment with flexible hanging loop.

3.2 FIELD QUALITY CONTROL

- A. Quality Requirements: Testing, adjusting, and balancing.
- B. Inspect isolated equipment after installation and submit report. Include static deflections.
- C. After start-up, final corrections and balancing of systems take octave band sound measurements over full audio frequency range in areas adjacent to mechanical equipment rooms, duct and pipe shafts, and other critical locations. Provide one-third octave band measurements of artificial sound sources in areas indicated as having critical requirements. Submit complete report of test results including sound curves.

PIPE ISOLATION SCHEDULE

Pipe Size Inch (mm)	Isolated Distance from Equipment
1 (25)	120 diameters (3.0 m)
2 (50)	90 diameters (4.5 m)
3 (80)	80 diameters (6.0 m)
4 (100)	75 diameters (7.5 m)
6 (150)	60 diameters (9.0 m)
8 (200)	60 diameters (12.0 m)
10 (250)	54 diameters (13.5 m)
12 (300)	50 diameters (15.0 m)
16 (400)	45 diameters (18.0 m)
24 (600)	38 diameters (23.0 m)
Over 24 (600)	

EQUIPMENT ISOLATION SCHEDULE

ISOLATED EQUIPMENT	BASE TYPE THICKNESS	ISOLATOR TYPE DEFLECTION
HVAC Pumps	B/C	2/3
Chillers	A	2
Fans (over 10 H.P.)	C	4

BASE TYPES:

- A = No base, isolators attached directly to equipment
- B = Structural steel rails or base
- C = Concrete inertia base
- D = Curb-mounted base

ISOLATOR TYPES:

- 1 = Rubber or glass fiber pad
- 2 = Rubber floor isolator or hanger
- 3 = Spring floor isolator or hanger
- 4 = Restrained spring isolator
- 5 = Thrust restraint
- 6 = Spring and rubber in series hanger

NOTES:

1. Contractor shall provide vibration isolation and calculations stamped by a licensed professional engineer.
2. To avoid isolator resonance problems, select isolator deflection so that natural frequency is 40% or less than lowest operating speed of equipment (see ASHRAE HVAC applications handbook, 1991 edition).

END OF SECTION 220553

SECTION 220553 - MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes nameplates, tags, stencils and pipe markers.

1.2 REFERENCES

- A. ASME A13.1 (American Society of Mechanical Engineers) - Scheme for the Identification of Piping Systems.
- B. NFPA 99 (National Fire Protection Association) - Standard for Health Care Facilities.

1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with the General Conditions of the Contract.
- B. Product Data: Submit manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved letters in contrasting background color.

2.2 TAGS

- A. Information Tags:
 - 1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches (83 x 143 mm) with grommet and self-locking nylon ties.
 - 2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges. Provide with brass chains for installation.
- B. Tag Chart: Typewritten letter size list of applied tags and location plastic laminated.

2.3 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. Up to 1 1/4 inches Outside Diameter of Insulation or Pipe: 1/2 inch-high letters.
 - 2. 1-1/2 to 2 inches outside diameter of insulation of pipe: 3/4 inch high letters.
 - 3. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1 1/4-inch high letters.
 - 4. Outside Diameter of Insulation or Pipe: 2 1/2 inches high letters.
 - 5. Over 10 inches outside diameter of pipe or insulation: 3-1/2 inch high letters.
 - 6. Ductwork and Equipment: 2-1/2 inches high letters.
- B. Stencil Paint: As specified in Architectural Painting Specifications, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers:
 - 1. Manufacturer:
 - a. Set mark type snap-around markers.
 - 2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Tape Pipe Markers:
 - 1. Manufacturer:
 - a. Brady Type 350.
 - 2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings, with legend, size and color coding.

2.5 CEILING TACKS

- A. Description: Steel with 3/4 inch (19 mm) diameter color-coded head.
- B. Color code as follows:
 - 1. HVAC equipment: Yellow.
 - 2. Fire dampers/smoke dampers: Red.
 - 3. Plumbing valves: Green.
 - 4. Heating/cooling valves: Blue.

2.6 LABELS

- A. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Architectural Painting Specifications for stencil painting.

3.2 INSTALLATION

- A. Apply stencil painting in accordance with Architectural Painting Specifications.
- B. Install identifying devices after completion of coverings and painting.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- E. Install tags using corrosion resistant chain. Number tags consecutively by location.
- F. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify air terminal units and radiator valves with numbered tags.
- J. Tag automatic controls, instruments, and relays. Key to control schematic.
- K. Identify piping, concealed or exposed, with plastic pipe markers, plastic tape pipe markers or stenciled painting. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

- L. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.3 SCHEDULES

IDENTIFICATION

1. Domestic Cold Water Piping.
 - a. Background Color: Green
2. Domestic Hot Water.
 - a. Background Color: Yellow
3. Hot water Heating.
 - a. Background Color: Yellow
 - b. With Directional Arrow.
4. Natural Gas.
 - a. Background Color: Orange
5. Ductwork.
 - a. Identification Type: N/A
6. Chilled Water
 - a. Background Color: Blue
 - b. With Directional Arrow.
7. Cooling Tower
 - a. Background Color: Light Green
 - b. With Directional Arrow.

END OF SECTION 220553

SECTION 220700 - MECHANICAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes ductwork insulation, duct liner, insulation jackets, covering, and thermal insulation for piping systems including vapor retarders, jackets and accessories.
- B. Related Sections:
 - 1. Section 220529 – Hangers and Supports: Execution requirements for inserts for placement by this section.
 - 2. Section 220523 – Mechanical Identification: Product requirements for mechanical identification for placement by this section.

1.2 REFERENCES

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.
- B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
- C. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
- D. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- E. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
- F. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- G. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation.
- H. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
- I. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- J. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation.
- K. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).

- L. ASTM C610 - Standard Specification for Expanded Perlite Block and Pipe Thermal Insulation.
- M. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- N. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
- O. ASTM C1126- Standard Specification for Preformed Closed Cell Phenolic Foam Pipe and Board Insulation.
- P. ASTM C1136 – Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- Q. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- S. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- T. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- U. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- V. NAIMA (North American Insulation Manufacturers Association) - National Insulation Standards.
- W. SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) - HVAC Duct Construction Standards - Metal and Flexible.

1.3 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location, as per the general conditions of the contract.
- B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

MECHANICAL INSULATION

220700 -2

- B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Certain-Teed

Owens-Corning

Johns-Manville

Armstrong

Knauf

Dow Chemical

2.2 GLASS MINERAL FIBER, FLEXIBLE BLANKET DUCT WRAP

- A. Insulation: Glass Fiber Blanket Thermal Insulation for Commercial and Industrial Applications. 1 ½" thick .075 pounds per cubic foot with a thermal conductivity of .24 at 75 degrees F.

MECHANICAL INSULATION

220700 -3

- B. Vapor Retarder Jacket: ASTM 1136, Type II Flexible and Low Permeance Vapor Retarders for Thermal Insulation. Perm rating shall not exceed .24 when tested in accordance with ASTM E96, Procedure A.
- C. Manufacturers:
 - 1. Manufacturers:
 - Certain-Teed
 - Owens-Corning
 - Johns-Manville
 - Armstrong
 - Knauf
 - Dow Chemical
 - 2. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- D. Indoor Vapor Retarder Finish:
 - 1. Manufacturers:
 - Certain-Teed
 - Owens-Corning
 - Johns-Manville
 - Armstrong
 - Knauf
 - Dow Chemical

2.3 CELLULAR GLASS PIPE INSULATION

- A. Insulation: ASTM C552, Type II – pipe and tubing insulation, Class 2 - Jacketed.
 - 1. 'K' ('ksi') factor: ASTM C177 or ASTM C518, 0.25at 75 degrees F.
- B. Vapor retarder jacket: Perm rating shall not exceed 0.25 when tested in accordance with ASTM E96, Procedure A.

2.4 PROTECTIVE INSULATION JACKET (PIPE INSULATION EXPOSED TO WEATHER)

A. Aluminum Jacket: ASTM B209.

1. Thickness: 0.016 inch thick sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.5 GLASS FIBER DUCT LINER, FLEXIBLE Insulation for Interior of sheet metal ducts.

A. Insulation: ASTM C1071 Thermal and Acoustical Insulation Glass Fiber, Duct Lining Material, Type I

B. Adhesive:

1. Waterproof, ASTM E162 fire-retardant type.

C. Liner Fasteners: Galvanized steel, welded with integral head.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify piping, equipment and ductwork has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Install in accordance with NAIMA National Insulation Standards.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. For hot piping conveying fluids over 110 degrees F, insulate flanges and unions at equipment.
- D. Glass fiber insulated pipes conveying fluids above ambient temperature:
 1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- E. Inserts and Shields:
1. Application: Piping or Equipment 1-1/2 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert location: Between support shield and piping and under finish jacket.
 4. Insert configuration: Minimum 6 inches (150 mm) long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 5. Insert material: Compression resistant insulating material suitable for planned temperature range and service.
- F. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07840 for penetrations of assemblies with fire resistance rating greater than one hour.
- G. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with stainless steel jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal equipment.
- H. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- I. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- J. Glass fiber insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor retarder, factory-applied or field-applied. Finish with glass cloth and adhesive.
- K. Finish insulation at supports, protrusions, and interruptions.
- L. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- M. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- N. Insulated ductwork conveying air below ambient temperature:
1. Provide insulation with vapor retarder jackets.
 2. Finish with tape and vapor retarder jacket.
 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

- O. Duct Liner Application:
1. Adhere insulation with adhesive for 100 percent coverage.
 2. Secure insulation with mechanical liner fasteners. SMACNA Standards for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.
 4. Seal liner surface penetrations with adhesive.
 5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.
- P. On cold & hot water piping that feeds exterior hose bibs & sill cocks, insulate entire pipe all the way to the fixture for freeze protection.
- Q. Install PVC jacket on the interior exposed insulation in the mechanical boiler room and in the mechanical penthouse.
- R. All chilled water and heating water storage tanks are to be insulated with 2" fiberglass insulation cloth coated and sewn with tight seal.

3.3 SCHEDULES

- A. Plumbing Systems:
1. Domestic & Industrial Hot Water Supply and Recirculation Systems:
 - a. Insulate entire system with fiberglass pipe covering with all service jacket and self seal lap. Insulation thickness as follows: 1" thick for all pipe sizes.
 2. Domestic & Industrial Cold Water:
 - a. Horizontal mains and elbows to vertical risers / drops: ½" thick fiberglass pipe covering with all service jacket and self-seal lap.
 3. Primary Roof Drains:
 - a. Horizontal mains and drain bowls with 1 inch thick fiberglass pipe covering with all service jacket and self-seal lap.
 - b. Bowls of secondary roof drains shall be insulated with 1 " thick foil scrim face.
 4. Fittings:
 - a. Pre-molded PVC fitting covers with fiberglass insert. In return air plenums use insulating cement finished with 6-ounce canvas and heavy coat of vapor barrier mastic coating.
- B. Provide aluminum jacket and fitting covers on all piping exposed to weather

END OF SECTION 220700

MECHANICAL INSULATION

220700 -7

**OGDEN COMMUNITY SERVICES BALLISTIC UPGRADE AND REMODEL
GSBS PROJECT. NO. 2023.040.00**

SECTION 221100 - DOMESTIC & INDUSTRIAL WATER PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes domestic & industrial water piping, valves, fittings, hangers, pumps, water softeners, controls and accessories.
- B. Related Sections:
 - 1. Section 220529: Hangers and Supports.
 - 2. Section 220548 – Mechanical Sound, Vibration, and Seismic Control: Product requirements for vibration isolators for placement by this section.
 - 3. Section 220700 – Mechanical Identification: Product requirements for pipe identification and valve tags for placement by this section.

1.2 REFERENCES

- A. ASME B16.1 (American Society of Mechanical Engineers) - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.
- B. ASME B16.18 (American Society of Mechanical Engineers) - Cast Copper Alloy Solder Joint Pressure Fittings.
- C. ASME B16.22 (American Society of Mechanical Engineers) - Wrought Copper and Bronze Solder Joint Pressure Fittings.
- D. ASME B16.26 (American Society of Mechanical Engineers) - Cast Bronze Fittings for Flared Copper Tubes.
- E. ASME B31.9 (American Society of Mechanical Engineers) - Building Service Piping.
- F. ASTM B32 - Solder Metal.
- G. ASTM B42 - Seamless Copper Pipe.
- H. ASTM B88 - Seamless Copper Water Tube (ASTM B88M - Seamless Copper Water Tube [Metric]).
- I. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- J. AWS A5.8 (American Welding Society) - Brazing Filler Metal.
- K. AWWA C651 (American Water Works Association) - Disinfecting Water Mains.

- L. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- M. MSS SP-67 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Butterfly Valves.
- N. MSS SP69 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Selection and Application.
- O. MSS SP-70 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Gate Valves, Flanged and Threaded Ends.
- P. MSS SP-71 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
- Q. MSS SP-78 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Plug Valves, Flanged and Threaded Ends.
- R. MSS SP-80 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Bronze Gate, Globe, Angle and Check Valves.
- S. MSS SP-85 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.
- T. MSS SP89 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Fabrication and Installation Practices.
- U. MSS SP-110 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- V. UL 1479 (National Fire Protection Association) - Fire Tests of Through-Penetration Firestops.
- W. ASME A1126.1 (American Society of Mechanical Engineers) - Water Hammer Arrestors.
- X. ASSE 1011 (American Society of Sanitary Engineering) - Hose Connection Vacuum Breakers.
- Y. ASSE 1012 (American Society of Sanitary Engineering) - Backflow Preventers with Immediate Atmospheric Vent.
- Z. ASSE 1013 (American Society of Sanitary Engineering) - Backflow Preventers, Reduced Pressure Principle.
- AA. ASSE 1019 (American Society of Sanitary Engineering) - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.

- BB. AWWA C506 (American Water Works Association) - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
- CC. PDI WH-201 (Plumbing and Drainage Institute) - Water Hammer Arrestors.
- DD. ASHRAE 90A (American Society of Heating, Refrigerating and Air Conditioning Engineers) - Energy Conservation in New Building.

1.3 SUBMITTALS

- A. Submittals: Provide as per the General Conditions of the Contract.
- B. Product Data:
 - 1. Submit data on pipe materials; pipe fittings, valves, and accessories. Submit manufacturers catalog information. Indicate valve data and ratings.
- C. Manufacturer's Installation Instructions: Submit installation instructions for valves and accessories.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of valves and equipment.
- B. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.7 WATER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

- A. Copper Tubing: ASTM B42, hard drawn.
 - 1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22 wrought copper and bronze.
 - 2. Joints: AWS A5.8, BCuP silver braze.
- B. Copper Tubing: ASTM B42, annealed
 - 1. Fittings: ASME B16.26 cast bronze.
 - 2. Joints: Flare

1.8 WATER PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B88 (ASTM B88M), Type L, hard drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, solder, Grade 95TA.
- B. Copper Tubing: ASTM B88 (ASTM B88M), Type L, hard drawn.
 - 1. Fittings: Cast iron, coated
 - 2. Joints: Grooved mechanical couplings.

1.9 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size 3 inches (80 mm) and Under:
 - 1. Ferrous pipe: Class 150 malleable iron threaded unions.
 - 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Pipe Size Over 1 inch (25 mm):
 - 1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 - 2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Grooved and Shouldered Pipe End Couplings:
 - 1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - 2. Sealing gasket: "C" shape composition sealing- gasket.

- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

1.10 PIPE HANGERS AND SUPPORTS

- A. Provide as per Section 220529.

1.11 WATER PRESSURE REDUCING VALVES

- A. Up to 2 inches (50 mm):
 - 1. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, and double union ends.
- B. Over 2 inches (50 mm):
 - 1. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flange

1.12 RELIEF VALVES

- A. Pressure Relief:
 - 1. AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuate.
- B. Temperature and Pressure Relief:
 - 1. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F (98.9 degrees C), capacity ASME SEC IV certified and labeled.

1.13 STRAINERS

- A. Size 2 inch (50 mm) and Under:
 - 1. Threaded brass body for 175 psi (1200 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
- B. Size 1-1/2 inch (40 mm) to 4 inch (100 mm):
 - 1. Class 125, flanged iron body, Y pattern with 1/16-inch (1.6 mm) stainless steel perforated screen.
- C. Size 5 inch (125 mm) and Larger:

1. Class 125, flanged iron body, basket pattern with 1/8 inch (2 mm) stainless steel perforated screen.

1.14 FIRE STOP SYSTEMS

- A. General Purpose Fire Stopping Sealant: Water based, non-slumping, premixed sealant with intumescent properties, rated for 3 hours in accordance with ASTM E814 and UL 1479.
- B. General Purpose Vibration Resistant Fire Stopping Sealant: Silicone based, non-slumping, premixed sealant with intumescent properties, vibration and moisture resistant, rated for 3 hours in accordance with ASTM E814 and UL 1479.

1.15 HOSE BIBS

- A. Interior: Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with lock shield and removable key, integral vacuum breaker in conformance with ANSI/ASSE 1011.
- B. Interior Mixing: Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, chrome plated where exposed with hand wheels, and vacuum breaker in conformance with ANSI/ASSE 1011.

1.16 HYDRANTS

- A. Wall Hydrant: ANSI/ASSE 1019; non-freeze, self-draining type with polished bronze, wall plate, lockable recessed box, hose thread spout, hand wheel, locks shield and removable key, and integral vacuum breaker.

1.17 BACKFLOW PREVENTERS

- A. Manufacturers: Conbraco, Watts, Febco, Hersey.
- B. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013 AWWA C506
 1. Bronze body, with bronze internal parts and stainless steel springs.
 2. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

1.18 WATER HAMMER ARRESTORS

- A. Manufacturers: Precision Plumbing Products Company (Wade Shokstop, JR Smith, Josam, Zurn)

- B. ANSI A1126.1; copper, construction, bellows, type sized in accordance with PDI WH-201.
- C. Pre-charged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi (1000 kPa) working pressure.

PART 2 EXECUTION

2.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavate

2.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.

2.3 INSTALLATION

- A. Install Work in accordance with International Plumbing Code and local / jurisdictional codes.
- B. Install trap primers on all floor drains and floor sinks.
- C. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- D. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- E. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- F. Group piping whenever practical at common elevations.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220529.
- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with General Contractor.
- I. Establish elevations of buried piping outside the building to obtain not less than 3-1/2 ft of cover.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

- K. Install valves with stems upright or horizontal, not inverted.
- L. Install water piping in accordance with ASME B31.9.
- M. Sleeve pipes passing through partitions, walls and floors.
- N. Inserts:
 - 1. Provide inserts for placement in concrete forms.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- O. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9 ASTM F708 and MSS SP89, and IPC Table.
 - 2. Support horizontal piping as schedule
 - 3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 - 7. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
 - 8. Provide copper plated hangers and supports for copper piping.
- P. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
- Q. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.
- R. Install water hammer arrestors in accordance to plumbing drainage institute standard WH-201. Provide 8" x 8" access panel to provide access to arrestor.

2.4 SERVICE CONNECTIONS

- A. Provide new water service complete with approved reduced pressure back-flow preventer and pressure reducing valve and sand strainer.

- B. Provide sleeve in wall for service main and support at wall with reinforced-concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

END OF SECTION 221100

SECTION 221300 - SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pipe, pipe fittings, connections and equipment for sanitary sewer piping systems. This section also includes floor drains, cleanouts, interceptors, manholes and sewage ejectors.
- B. Related Sections: Section 220529: Hangers and Supports.
 - 1. Section 220553 - Mechanical Identification: Product requirements for pipe identification for placement by this section.

1.2 REFERENCES

- A. ASME B13 (American Society of Mechanical Engineers) - Malleable Iron Threaded Fittings.
- B. ASME B123 (American Society of Mechanical Engineers) - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- C. ASME B31.9 (American Society of Mechanical Engineers) - Building Services Piping.
- D. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- E. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- F. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- G. ASTM E814 - Fire Tests of Through-Penetration Fire Stops.
- H. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- I. ASME A1121.1 (American Society of Mechanical Engineers) - Floor Drains.
- J. CISPI 301 (Cast Iron Soil Pipe Institute) - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- K. CISPI 310 (Cast Iron Soil Pipe Institute) - Joints for Hubless Cast Iron Sanitary Systems.
- L. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- M. SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

- N. UL 1479 (Underwriters Laboratories, Inc.) - Fire Tests of Through-Penetration Firestops.

1.3 SUBMITTALS

- A. Provide in accordance with the General Conditions of the Contract.
- B. Product Data: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information. Indicate component sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

- A. Acrylonitrile Butadiene Styrene (ABS): ASTM D 2661; ASTM F 628; CSA B181.1.
 - 1. Fittings: ABS meeting ASTM D 3311, CSA B181.1, and ASTM D 2661.
 - 2. Joints: See 2021 IPC Section 705.2.

2.2 SANITARY SEWER AND VENT PIPING, BELOW GRADE

- A. Polyvinyl Chloride (PVC) Plastic Pipe: ASTM D 2665, ASTM D 2949, ASTM F 891, CSA B181.2, ASTM F 1488.
 - 1. Fittings: PVC meeting ASTM D 3311, ASTM D 2665, ASTM F 1866.
 - 2. Joints: See 2021 IPC Section 705.14.

B. Acrylonitrile Butadiene Styrene (ABS): ASTM D 2661; ASTM F 628; CSA B181.1.

1. Fittings: ABS meeting ASTM D 3311, CSA B181.1, and ASTM D 2661.
2. Joints: See 2021IPC Section 705.2.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.4 PIPE HANGERS AND SUPPORTS

A. Drain, Waste, and Vent: Conform to ASME B31.9, ASTM F708.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm): Carbon steel, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inches (50 mm) and Over: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes to 3 inches (80 mm): Cast iron hooks.

F. Wall Support for Pipe Sizes Over 3 inches (100 mm): Welded steel bracket and wrought steel clamp.

G. Vertical Support: Steel riser clamp.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Copper Pipe Support: Carbon-steel, copper-plated adjustable ring.

2.5 FIRE STOP SYSTEMS

A. General Purpose Fire Stopping Sealant: Water based, non-slumping, premixed sealant with intumescent properties, rated for 3 hours in accordance with ASTM E814 and UL 1479.

B. General Purpose Vibration Resistant Fire Stopping Sealant: Silicone based, non-slumping, premixed sealant with intumescent properties, vibration and moisture resistant, rated for 3 hours in accordance with ASTM E814 and UL 1479.

2.6 FLOOR DRAINS

A. Manufacturers: Wade, JR Smith, Zurn, Mifab

- B. Provide as scheduled on the Drawings.
- C. Floor Drain: Lacquered cast iron two piece body with drainage flange, heavy duty grate 6 inches (150 mm) 12 inches (300 mm) wide, 12 inches (300 mm) long, dome strainer, end plates with gaskets.
- D. All floor drains and floor sinks are to have trap primers installed.

2.7 FLOOR SINKS

- A. Manufacturers: Wade, J.R. Smith, Zurn, Mifab
- B. Provide as scheduled on the Drawings.
- C. All floor drains and floor sinks are to have trap primers installed.

2.8 CLEANOUTS

- A. Manufacturers: Wade, J.R. Smith, Zurn, Mifab
- B. Exterior Surfaced Areas: Round cast nickel bronze access frame and non-skid cover.
- C. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket.
- D. Interior Finished Floor Areas: Galvanized cast iron body with anchor flange, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.
- E. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.
- F. Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.

SANITARY WASTE AND VENT PIPING

221300 - 4

- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

- A. Install Work in accordance with International Plumbing Code and current local / jurisdictional standards.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- G. Install piping to maintain headroom. Do not spread piping, conserving space.
- H. Group piping whenever practical at common elevations.
- I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220700.
- J. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with General Contractor.
- K. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- N. Install bell and spigot pipe with bell end upstream.
- O. Sleeve pipes passing through partitions, walls and floors.
- P. Inserts:
 - 1. Provide inserts for placement in concrete forms.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

Q. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping packing between hanger or support and piping.

END OF SECTION 221300

SECTION 230593 – TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes testing, adjusting, and balancing of air systems, testing, adjusting, and balancing of hydronic systems, measurement of final operating condition of HVAC systems, sound measurement of equipment operating conditions, vibration measurement of equipment operating conditions.

1.2 REFERENCES

- A. AABC (Associated Air Balance Council) - National Standards for Total System Balance.
- B. ASHRAE 111 (American Society of Heating, Refrigerating and Air-Conditioning Engineers) - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- C. NEBB (National Environmental Balancing Bureau) - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.3 SUBMITTALS

- A. Provide in accordance with the General Conditions of the Contract.
- B. Test Reports: Indicate data on AABC National Standards for Total System Balance forms or NEBB Report forms.
- C. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- D. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
- E. Submit draft copies of report for review prior to final acceptance of Project. Furnish final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.
- F. Furnish reports in a 3-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
- G. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty and Copy of NEBB Certificate of Conformance Certification prior to commencing system balance.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of flow measuring stations balancing valves and rough setting.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum 10 years documented experience certified by AABC or Certified by NEBB.
- B. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.
- C. Acceptable contractors are
 - 1. BTC services, Certified Testing & Balancing.
 - 2. Other may be accepted upon approval of Mechanical Engineer Submit qualifications to Josh Elliott, P.E.: jelliott@pve-ut.com. All prior approvals must be submitted at least one week from bid date to be considered.

1.7 SEQUENCING

- A. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.8 SCHEDULING

- A. Schedule and provide assistance in final adjustment and test of life safety system with Fire Authority.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify systems are complete and operable before commencing work. Verify the following:
 - 1. Systems are started and operating in safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
 - 12. Hydronic systems are flushed, filled, and vented.
 - 13. Pumps are rotating correctly.
 - 14. Proper strainer baskets are clean and in place or in normal position.
 - 15. Service and balancing valves are open.
- B. Submit field reports. Report defects and deficiencies noted during performance of services, preventing system balance.

3.2 PREPARATION

- A. Furnish instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design.
- B. Air Outlets and Inlets: Adjust total to within plus 5 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 5 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 5 percent of design.

3.4 ADJUSTING

- A. Verify recorded data represents actual measured or observed conditions.

TESTING, ADJUSTING, AND BALANCING

230593 - 3

- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.
- F. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.
- E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.
- F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

- K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches positive static pressure near building entries.
- M. On fan powered VAV boxes, adjust airflow switches for proper operation.

3.6 WATER SYSTEM PROCEDURE

- A. Adjust water systems, after air balancing, to obtain design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.
- C. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open or in normal position to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.

3.7 SCHEDULES

END OF SECTION 230593

SECTION 232116 – PIPING SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pressure gages and pressure gage taps, thermometers and thermometer wells, static pressure gages, filter gages. Section also includes, expansion tanks, air vents, air separators, strainers, pump suction fittings, combination fittings, flow indicators, controls, meters. Section also includes glycol specialties, pressure-reducing valves.
- B. Related Sections:
 - 1. Section 23 20 00 – Heating and Cooling Piping: Execution requirements for piping connections to products specified by this section.

1.2 REFERENCES

- A. ASME (American Society of Mechanical Engineers) - Boiler and Pressure Vessel Codes, SEC VIII-D - Rules for Construction of Pressure Vessels.
- B. ASME B40.1 (American Society of Mechanical Engineers) - Gauges - Pressure Indicating Dial Type - Elastic Element.
- C. ASTM E1 - Standard Specification for ASTM Thermometers.
- D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
- E. ASTM A105 - Forgings, Carbon Steel, for Piping Components.
- F. ASTM A126 - Grey Iron Castings for Valves, Flanges, and Pipe Fittings.
- G. ASTM A216 - Steel Casings, Carbon, Suitable for Fusion Welding, for High Temperature Service.
- H. ASTM A395 - Ferric Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

1.3 SUBMITTALS

- A. Product Data: Submit for manufactured products and assemblies used in this Project as per the General Conditions of this Contract.
 - 1. Manufacturer's data indicating use, operating range, total range, accuracy, and location for manufactured components.

2. Submit product description, model, dimensions, component sizes, service sizes, and finishes.
3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each specialty.
4. Submit electrical characteristics and connection requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Execution Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of components and instrumentation, flow controls flow meters.
- C. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list as per the General Conditions of the Contract.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements before fabrication.

1.8 MAINTENANCE SERVICE

- A. Execution Requirements: Maintenance service.
- B. Furnish bi-annual visit for one year starting from Date of Substantial Completion to make glycol fluid concentration analysis on site with refractive index measurement instrument. Detail findings with maintenance personnel in writing of corrective actions needed including analysis and amounts of glycol or water added.

1.9 EXTRA MATERIALS

- A. Provide sufficient inhibited propylene glycol to maintain specified concentrations for the one-year warranty period.

PART 2 PRODUCTS

2.1 PRESSURE GAGES

- A. Gage: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
 - 1. Case: Cast Aluminum.
 - 2. Bourdon Tube: Brass.
 - 3. Dial Size: 4-1/2 inch (114 mm).
 - 4. Mid-Scale Accuracy: One.
 - 5. Scale: Both psi and kPa.

2.2 PRESSURE GAGE TAPS

- A. Needle Valve:
 - 1. Brass, 1/4 inch (6 mm) NPT for minimum 300 psi (2070 kPa).
- B. Ball Valve:
 - 1. Brass, 1/4 inch (6 mm) NPT for 250 psi (1720 kPa).
- C. Pulsation Damper:
 - 1. Pressure snubber, brass with 1/4 inch (6 mm) NPT connections.

2.3 STEM TYPE THERMOMETERS

- A. Manufacturers: Weiss Instruments
- B. Thermometer: Vari-Angle Digital industrial glass thermometer that is self-powered.
 - 1. Case: Hi-impact ABS
 - 2. Range: -40 / 300°F
 - 3. Display: 3/8" LCD digits, wide ambient formula
 - 4. Accuracy: 1 percent of reading or 1°F whichever is greater
 - 5. Re-Calibration: Internal potentiometer
 - 6. Update: Every 10 seconds
 - 7. Resolution: 1/10° between -19.9 / 199.9°F

8. Lux Rating: 10 Lux (one foot-candle)
9. Sensor: Glass passivated thermistor
10. Ambient Temp Error: Zero
11. Stem Assemblies: Industrial Glass - Full conformance with Fed. Spec. GG-T-321D. Fully interchangeable with Industrial Glass Thermometers
12. Model: DVS35

2.4 TEST PLUGS

- A. Manufacturers: Teriece, Fairfax, Peterson Equipment.
- B. 1/4 inch (6 mm) NPT or 1/2 inch (13 mm) NPT brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with:
 1. Neoprene core for temperatures up to 200 degrees F (93 degrees C).
 2. Nordel core for temperatures up to 350 degrees F (176 degrees C).
 3. Viton core for temperatures up to 400 degrees F (204 degrees C).
 4. Extension for insulated pipe.
- C. Test Kit:
 1. Carrying case, internally padded and fitted containing:
 - a. One 2-1/2 inch (64 mm) diameter pressure gages.
 - 1) Scale range: 0 to 100 psi
 - b. One gage adapters with 1/8 inch (3 mm) probes.
 - c. Two 1-1/2 inch (38 mm) dial thermometers.
 - 1) Scale range: 30 to 240 degrees F.

2.5 DIAPHRAGM-TYPE EXPANSION TANKS

- A. Construction: Welded steel, tested and stamped in accordance with ASME SEC 8-D; supplied with National Board Form U-1, rated for working pressure of 125 psig (860 kPa), with flexible EPDM diaphragm sealed into tank, and steel support stand.
- B. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 20 psig
- C. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure back flow prevention device, test cocks, strainer, vacuum breaker, and by-pass valves.
- D. Size: As Scheduled on the Drawings.

2.6 AIR VENTS

- A. Manual Type: Short vertical sections of 2 inch (50 mm) diameter pipe to form air chamber, with 1/8 inch (3 mm) brass needle valve at top of chamber.
- B. Float Type:
 - 1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.7 AIR SEPARATORS

- A. Manufacturers: Bell and Crossett, Amtrol, Armstrong, Taco.
- B. Dip Tube Fitting:
 - 1. For 125 psig (860 kPa) operating pressure; to prevent free air collected in boiler from rising into system.
- C. In-line Air Separators:
 - 1. Cast iron for sizes 1-1/2 inch (40 mm) and smaller, or steel for sizes 2 inch (50 mm) and larger; tested and stamped in accordance with ASME SEC 8-D; for 125 psig (860 kPa) operating pressure.
- D. Combination Air Separators/Strainers:
 - 1. Steel, tested and stamped in accordance with ASME SEC 8-D; for 125 psig (860 kPa) operating pressure, with integral galvanized steel strainer, tangential inlet and outlet connections, and internal stainless steel air collector tube.
- E. Size: As scheduled in drawing.

2.8 STRAINERS

- A. Manufacturers: Armstrong, Itt, Keckley, Mueller, Metraflex, Victaulic, Gustin, and Bacon.
- B. Size 2 inch (50 mm) and Under:
 - 1. Screwed brass or iron body for 175 psig (1200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
- C. Size 2-1/2 inch (65 mm) to 4 inch (100 mm):
 - 1. Flanged iron body for 175 psig (1200 kPa) working pressure, Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.
- D. Size 5 inch (125 mm) and Larger:

1. Flanged iron body for 175 psig (1200 kPa) working pressure, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

2.9 FLOW METERS

- A. Manufacturers: Bell and Crossett, Lierand, Armstrong, Taco, Amtrol.
- B. Orifice type by-pass circuit with direct reading gage, soldered or flanged piping connections for 125 psig (860 kPa) working pressure, with shut off valves, and drain and vent connections.
- C. Direct reading with insert pitot tube, threaded coupling, for 150 psig (1034 kPa) working pressure, maximum 240 degrees F (115 degrees C), 5 percent accuracy.
- D. Cast iron, wafer type, orifice insert flow meter for 250 psig (1720 kPa) working pressure, with read-out valves equipped with integral check-valves and caps with gaskets.
- E. Calibrated, plug type balancing valve with precision-machined orifice, readout valves equipped with integral check valves and caps with gaskets, calibrated nameplate and indicating pointer.
- F. Cast iron or bronze, globe style, balancing valve with hand wheel with vernier type ring setting and memory stop, drain connection, readout valves equipped with integral check valves and caps with gaskets.

2.10 RELIEF VALVES

- A. Manufacturers: Kunkle, Watts, McDonnell & Miller.
- B. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.11 GLYCOL CHARGING

- A. Mixing Tank: 55 gallon steel drum with fittings suitable for filling and hand pump for charging, rubber hose for connection of hand pump to system.
- B. Storage Tank: Closed type, welded steel constructed, tested and stamped in accordance with ASME SEC 8-D; 100 psi rating; cleaned, prime coated, and supplied with steel support saddles. Construct with taps for installation of accessories.

2.12 GLYCOL SOLUTION

- A. Inhibited propylene glycol and water solution mixed 35 percent glycol - 65 percent water. (As scheduled in drawing) See pump schedule for other requirements.

PIPING SPECIALTIES

232116 - 6

PART 3 EXECUTION

2.13 INSTALLATION

- A. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.
- B. Install gage taps in piping
- C. Install pressure gages with pulsation dampers.
- D. Provide needle valve or ball valve to isolate each gage. Extend nipples to allow clearance from insulation.
- E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches (64 mm) for installation of thermometer sockets. Allow clearance from insulation. Thermometers are to be installed on chilled water system at or near the chiller, on boiler system at or near both the boiler and secondary heating system, on domestic water system at or near the water heater, on the cold water entry, and on steam systems.
- F. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.
- G. Install static pressure gages to measure across filters and filter banks, (inlet to outlet). On multiple banks, provide manifold and single gage.
- H. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- I. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- J. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- K. Locate test plugs.
- L. Install manual air vents at system high points.
- M. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- N. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- O. Provide drain and hose connection with valve on strainer blow down connection.

- P. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
- Q. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- R. Pipe relief valve outlet to nearest floor drain.
- S. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
- T. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Set to fill at final field verified psi.

2.14 FIELD QUALITY CONTROL

- A. Test for strength of glycol and water solution and submit written test results.

2.15 CLEANING

- A. Clean and flush glycol system before adding glycol solution.

2.16 PROTECTION OF INSTALLED CONSTRUCTION

- A. Do not install hydronic and steam pressure gauges until after systems are pressure treated.
Capacity

END OF SECTION 232116

SECTION 233100 - DUCTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes metal ductwork, nonmetallic ductwork, casing and plenums, buried ductwork, kitchen hood ductwork, duct cleaning.
- B. Related Sections:
 - 1. Section 220529 – Hangers and Supports: Product requirements for hangers, supports and sleeves for placement by this section.

1.2 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.
- E. ASTM A568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
- F. ASTM A569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
- G. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- H. NFPA 90A (National Fire Protection Association) - Installation of Air Conditioning and Ventilating Systems.
- I. NFPA 90B (National Fire Protection Association) - Installation of Warm Air Heating and Air Conditioning Systems.
- J. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) - HVAC Air Duct Leakage Test Manual.
- K. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) - HVAC Duct Construction Standards - Metal and Flexible.
- L. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) - Fibrous Glass Duct Construction Standards.

DUCTS

233100 - 1

M. UL 181 (Underwriters Laboratories, Inc.) - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is permitted except by written permission. Size No round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.4 SUBMITTALS

- A. Provide complete ductwork shop drawings in accordance with the General Conditions of the Contract.
- B. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.
- C. Manufacturer's Installation Instructions: Submit special procedures for glass fiber ducts.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.
- B. Construct ductwork to NFPA 90A and NFPA 90B standards.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealant.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

DUCTS

233100 - 2

1.9 WARRANTY

- A. Furnish 1 year manufacturers warranty for ducts.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90.
- B. Steel Ducts: ASTM A366 A569 A568.
- C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061- T6 or of equivalent strength.
- D. Fasteners: Rivets, bolts, or sheet metal screws.
- E. Hanger Rod: ASTM A36; steel, galvanized threaded both ends, threaded one end, or continuously threaded.

2.2 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings. Furnish duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch (100 mm) cemented slip joint, brazed or electric welded. Prime coat welded joints.
- E. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

2.3 Insulated Flexible Ducts:

- A. When using flexible duct, contractor is to install rigid duct with a 90° elbow facing down, then install flex duct vertically from the 90° elbow to the grille or register. There are cases where this is not possible and we understand this.
- B. Two ply vinyl film supported by helical wound spring steel wire; fiberglass insulation; polyethylene aluminized vapor barrier film.
 - 1. Pressure Rating: 10 inches wg (2.50 kPa) positive and 1.0 inches wg (250 Pa) negative.
 - 2. Maximum Velocity: 4000 fpm (20.3 m/sec).
 - 3. Temperature Range: -10 degrees F to 160 degrees F (-23 degrees C to 71 degrees C).

2.4 GLASS FIBER DUCTS

- A. Fabricate in accordance with SMACNA Fibrous Glass Duct Construction Standards, except as indicated on Drawings. (Return air boots and transfer ducts only).
- B. Pressure sensitive tape, UL approved. 2 inch (50mm) wide pressure sensitive tape, UL approved.
- C. Machine-fabricate glass fiber ducts and fittings. Make only minor on site manual adjustments.
- D. Staple duct joints and tape with 3 inch (75 mm) wide 2 mil (0.05) thick or 2 inch (50 mm) wide 3 mil (0.75 mm) thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

- A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Install glass fiber ducts in accordance with SMACNA Fibrous Glass Duct Construction Standards. Obtain manufacturer's inspection and acceptance of fabrication and installation at beginning of installation.
- C. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

DUCTS

233100 - 4

- D. Use crimp joints with or without bead or beaded sleeve couplings for joining all round ducts.
- E. Use double nuts and lock washers on threaded rod supports.
- F. Connect flexible ducts to metal ducts with draw bands. Maximum flex duct length 4'.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.
- B. Connect terminal units to supply ducts directly. Do not use flexible duct to change direction.

3.4 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.5 SCHEDULES

DUCTWORK MATERIAL SCHEDULE

AIR SYSTEM	MATERIAL
Supply (Heating Systems)	Galvanized Steel, Aluminum
Supply (System with Cooling Coils)	Galvanized Steel, Aluminum
Return and Relief	Galvanized Steel, Aluminum
General Exhaust	Galvanized Steel, Aluminum
Transfer Air and Sound Boots	Fibrous Glass Duct.

END OF SECTION 233100

DUCTS

233100 - 5

**OGDEN COMMUNITY SERVICES BALLISTIC UPGRADE AND REMODEL
GSBS PROJECT. NO. 2023.040.00**

SECTION 233300 - DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes back-draft dampers, combination fire-and-smoke dampers, duct access doors, fire dampers, smoke dampers, volume control dampers, flexible duct connections and duct test holes.
- B. Related Sections:
 - 1. Division 16 - Wiring Devices: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this section.
 - 2. Section 230900 - HVAC Instrumentation: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.

1.2 REFERENCES

- A. NFPA 90A (National Fire Protection Association) - Installation of Air Conditioning and Ventilating Systems.
- B. NFPA 92A (National Fire Protection Association) - Smoke Control Systems.
- C. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) - HVAC Duct Construction Standards - Metal and Flexible.
- D. UL 33 (Underwriters Laboratories, Inc.) - Heat Responsive Links for Fire-Protection Service.
- E. UL 555 (Underwriters Laboratories, Inc.) - Fire Dampers and Ceiling Dampers.
- F. UL 555S (Underwriters Laboratories, Inc.) - Leakage Rated Dampers for Use in Smoke Control Systems.

1.3 SUBMITTALS

- A. Provide in accordance with the General conditions of the Drawings.
- B. Product Data: Submit data for shop fabricated assemblies including volume control dampers duct access doors and hardware used. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of access doors and test holes.
- C. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.7 COORDINATION

- A. Coordinate Work where appropriate with building control Work.

PART 2 PRODUCTS

2.1 COMBINATION FIRE AND SMOKE DAMPERS

- A. Fabricate in accordance with NFPA 90A, UL 555, and UL 555S.
- B. Multiple-Blade Dampers: Fabricate with 16 gage (1.5 mm) galvanized steel frame and blades. Furnish oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch (3.2 x 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch (12.7 mm) actuator shaft.
- C. Operators: UL listed and labeled spring return electric type suitable for 120 volts, single phase, 60 Hz. Furnish end switches to indicate damper position. Locate damper operator on interior or exterior of duct and link to damper operating shaft.
- D. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of Electro thermal link, flexible stainless steel blade edge seals to produce constant sealing pressure.
- E. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of Electro thermal link, flexible stainless steel blade edge seals to produce constant sealing pressure, stainless steel springs with locking devices to maintain positive closure for units mounted horizontally.

DUCT ACCESSORIES

233300 - 2

- F. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.2 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch (25 mm) thick insulation with sheet metal cover.
 - 1. Less Than 12 inches (300 mm) square, secure with sash locks.
 - 2. Up to 18 inches (450 mm) Square: Furnish two hinges and two sash locks.
 - 3. Up to 24 x 48 inches (600 x 1200 mm): Three hinges and two compression latches with outside and inside handles.
 - 4. Larger Sizes: Furnish additional hinge.
 - 5. Access panels with sheet metal screw fasteners are not acceptable.

2.3 FIRE DAMPERS

- A. Fabricate in accordance with NFPA 90A and UL 555, and manufacturer's condition of listing. Permanently mark dampers for use in static systems.
- B. Horizontal Dampers: Galvanized steel, 22 gage (0.76 mm) frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- C. Curtain Type Dampers: Galvanized steel with interlocking blades. Furnish stainless steel closure springs and latches for horizontal installations conditions. Configure with blades out of air stream except for 1.0-inch 250 Pa pressure class ducts up to 12 inches (300 mm) in height.
- D. Multiple Blade Dampers: 16 gage (1.5 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch (3.2 x 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- E. Fusible Links: UL 33, separate at 160 with adjustable link straps for combination fire/balancing dampers.

2.4 VOLUME CONTROL DAMPERS.

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

- B. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch (200 x 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.
- C. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.
- D. Quadrants:
 - 1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
 - 3. Where rod lengths exceed 30 inches (750 mm) furnish regulator at both ends.

2.5 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
- B. Connector: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
 - 2. Net Fabric Width: Approximately 3 inches wide.
 - 3. Metal: 3 inch wide, 24 gage galvanized steel.

2.6 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify rated walls are ready for fire damper installation.
- B. Verify ducts and equipment installation are ready for accessories.

DUCT ACCESSORIES

233300 - 4

3.2 INSTALLATION.

- A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 233100 for duct construction and pressure class.
- B. Install duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and as indicated on Drawings. Install minimum 8 x 8 inch (200 x 200 mm) size for hand access, 18 x 18 inch (450 x 450 mm) size for shoulder access, and as indicated on Drawings. Install 4 x 4 inch (100 x 100 mm) for balancing dampers only. Review locations prior to fabrication.
- C. Install duct test holes required for testing and balancing purposes.
- D. Provide fire dampers, combination fire and smoke dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.

3.3 DEMONSTRATION AND TRAINING

- A. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION 233300

SECTION 234000 – AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes disposable panel filters, filter frames, filter gages.

1.2 REFERENCES

- A. ARI 850 (Air-Conditioning and Refrigeration Institute) - Commercial and Industrial Air Filter Equipment.
- B. ASHRAE 52 (American Society of Heating, Refrigerating and Air Conditioning Engineers) - Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- C. MIL-STD-282 - Filter Units, Protective Clothing, Gas-Mask Components, and related Products: Performance-Test Methods.

1.3 PERFORMANCE REQUIREMENTS

- A. Conform to ARI 850 Section 7.4.

1.4 SUBMITTALS

- A. Per Section 01 00 15.
- B. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.
- C. Product Data: Submit data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Submit assembly and change-out procedures.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit instructions for operation, changing, and periodic cleaning.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 WARRANTY

- A. Furnish one year manufacturer warranty for air cleaning devices.

1.8 EXTRA MATERIALS

- A. Furnish one set of disposable panel filters.

PART 2 PRODUCTS

2.1 DISPOSABLE PANEL FILTERS

- A. Manufacturers: Farr, American Air Filter, ECO Air.
- B. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.
 - 1. Nominal Size: 24 x 24 inches (610 x 610 mm).
 - 2. Thickness: 2 inch (50 mm).
- C. Performance Rating:
 - 1. Face Velocity: 500 fpm (2.54 m/sec)
 - 2. Initial Resistance: 0.10 inch wg (25 Pa)
 - 3. Recommended Final Resistance: 0.50 inches wg (125 Pa).
- D. Casing: Cardboard-frame with perforated metal retainer.

2.2 FILTER FRAMES AND HOUSINGS

- A. General: Fabricate filter frames and supporting structures of 16 gage (1.50 mm) galvanized steel or extruded aluminum T-section construction with necessary gaskets between frames and walls.
- B. Standard Sizes: For interchange ability of filter media of other manufacturers; for panel filters, size for 24 x 24 inches (610 x 610 mm) filter media, minimum 2 inches (50 mm)

thick; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.

2.3 FILTER GAGES

- A. Inclined Manometer: One piece molded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, range 0-3 inch wg (0-750 Pa), 3 percent of full scale accuracy.
- B. Accessories: Static pressure tips with integral compression fittings, 1/4 inch tubing, 2-way or 3-way vent valves.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- B. Install filter gage static pressure tips upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and level.
- C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.
- D. Install filter gages on filter banks with separate static pressure tips upstream and downstream of filters.

END OF SECTION 234000

SECTION 260001 - ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Architectural, Structural, Mechanical and other applicable documents also apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. The contract documents indicate the extent of electrical work. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system as described in divisions 26, 27, and 28.

1.3 RELATED SECTIONS:

- A. Other Divisions relating to electrical work apply to the work of this section. See other applicable Divisions including, but not necessarily limited to:
 - 1. Division 1 – General and Supplementary Conditions
 - 2. Division 2 – Existing Conditions
 - 3. Division 3 – Concrete
 - 4. Division 5 – Metals
 - 5. Division 6 – Wood, Plastics, and Composites
 - 6. Division 7 – Thermal and Moisture Protection
 - 7. Division 8 – Openings
 - 8. Division 9 – Finishes
 - 9. Division 21 – Fire Suppression
 - 10. Division 22 – Plumbing
 - 11. Division 23 – Heating Ventilating and Air Conditioning
 - 12. Division 27 – Communications
 - 13. Division 28 – Electronic Safety and Security

1.4 INTERPRETATIONS OF DRAWINGS AND SPECIFICATIONS:

- A. Prior to bidding the job, submit requests for clarification in writing to the Architect/Engineer prior to issuance of the final addendum.
- B. After signing the contract, provide all materials, labor, and equipment to meet the intent, purpose, and function of the contract documents.
- C. The following terms used in Division 26, 27, and 28 documents are defined as follows:
 - 1. "Provide" - Means furnish, install, and connect, unless otherwise indicated.
 - 2. "Furnish" - Means purchase new and deliver in operating order to project site.

3. "Install" - Means to physically install the items in-place.
4. "Connect" - Means make final electrical connections for a complete operating piece of equipment. This includes providing conduit, wire, terminations, etc. as applicable.
5. "Or Equivalent" - Means to provide equivalent equipment. Such equipment must be approved by the Engineer prior to bidding.

1.5 EXAMINATION OF SITE:

- A. Visit the site and verify existing field conditions prior to submitting bid.
- B. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

1.6 QUALITY ASSURANCE:

- A. Perform work in accordance with all governing codes, rules, and regulations including the following minimum codes (latest editions or as otherwise accepted by the Authorities Having Jurisdiction):
 1. National Electric Code (NEC)
 2. International Building Code (IBC)
 3. International Fire Code (IFC)
 4. International Mechanical Code (IMC)
 5. International Plumbing Code (IPC)
 6. American Disability Act (ADA)
 7. National Electrical Safety Code (NESC)
 8. Local Codes and Ordinances
- B. Comply with all standards where applicable for equipment and materials including the following minimum standards:
 1. Underwriter's Laboratories (UL)
 2. American Society for testing Materials (ASTM)
 3. Certified Ballast Manufacturers (CBM)
 4. Insulated Cable Engineers Association (ICEA)
 5. National Electrical Manufacturer's Institute (NEMA)
 6. American National Standards Institute (ANSI)
 7. Electrical Testing Laboratories (ETL)
 8. National Fire Protection Association (NFPA)
 9. Institute of Electrical and Electronics Engineers (IEEE)
 10. American Institute of Electrical Engineer's Electrical Power
 11. Systems and Grounding in Commercial Construction
 12. Illuminating Engineers Society (IES)
- C. Provide new electrical equipment conforming to all requirements as set forth in the above standards. Provide UL labeled equipment where such label is applicable.
- D. Comply with all state and local codes and ordinances. When conflicts occur among codes, standards, drawings, and/or specifications, the most stringent requirements shall govern.
- E. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in

bid. Provide a certificate of approval to the owner's representative from the inspection authority at completion of the work.

- F. Provide only first-class workmanship from competent workers, conforming to the best electrical construction practices.
- G. The contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

1.7 SUBMITTALS:

- A. After the Contract is awarded but prior to ordering, manufacturing, or installation of any equipment, prepare complete Submittals including shop drawings, product data, cut sheets, etc. for materials and equipment as required by each section of the specifications.
- B. Review of Submittals shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from the Contract Document's requirements. The noting of some errors but overlooking others, during the submittal review process, does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings and cut sheets, the requirements of the Contract Document's shall govern and are not waived or superseded in any way by the review of the shop drawings and cut sheets.
- C. Submit only materials and equipment specified in Construction Documents or Addendums.
- D. Submittals are reviewed, not approved. Comments made within submittals do not alter the contract documents in any way. The contractor is still responsible, regardless of comments (if any) made within Submittals, for complying with drawings and specifications.
- E. Notify Engineer in writing if any of the submittal review comments alter the Construction Documents or affect the Contract cost. A submittal review comment which alters the Construction Documents and/or increases/decreases cost of a product is not an authorization to the Contractor under any circumstances to proceed. It is the responsibility of the Contractor to ensure compliance.
- F. Electronic Submittal Requirements:
 - 1. Provide submittals in Portable Document Format (PDF).
 - 2. Documents must be electronically bookmarked by Division (i.e. 26, 27 and 28), Specification section (i.e. 260120), and individually for each item submitted for light fixtures, switchgear, transformer, panelboard etc. and keyword searchable using Adobe Acrobat (<http://www.adobe.com/acrobat>) or Bluebeam Revu (<http://www.bluebeam.com>) for each relevant section.
 - 3. Electronically highlight all options for light fixtures, electrical equipment, etc. Manual highlighting and scanning of the documents are not acceptable and will not be reviewed.
 - 4. Do not submit catalog sheets which describe several different items in addition to those items to be used unless all relevant information is clearly identified.
 - 5. Provide combined submittals grouping the related specification sections together:
 - a. Switchboards, Panelboards, Surge Protective Devices, Overcurrent Protective Devices, Service Entrance, Protective Device Study, Electricity Metering, and similar.
 - b. Disconnect Switches, Motor Starters, and similar.

- c. Emergency Electrical Systems, Quick-Connect Panelboards, and similar.
 - d. Conduit Raceways, Electrical Boxes and Fittings, Raceway Systems, and similar.
 - e. Conductors and Cables, Grounding, and similar.
 - f. Interior and Exterior Building Lighting, Exterior Area Lighting, Lighting Control Relay Panel Systems, and similar.
 - g. Other submittal groups with related specification sections.
- Exceptions may be given, with prior approval, for time-sensitive equipment.
- 6. A maximum of one submittal per specification section is allowed. It is not acceptable to provide a product-by-product submittal. Single product by product submittals will not be reviewed.

G. Scheduling:

- 1. A minimum period of two weeks (business days only), exclusive of transmittal time, will be required each time Submittals are submitted or resubmitted for review. This time shall be considered by the Contractor when scheduling submittal data.

H. Response to Specifications:

- 1. A point-by-point statement of compliance with the specifications must be submitted with each individual submittal.
- 2. The statement of compliance shall consist of numbered specification paragraphs and shall be located at the front of the submittal. Each specification paragraph shall be cross referenced to the page/drawing in the submittal on which the compliance is confirmed. The confirming data on the page/drawing shall be highlighted for ready identification.
- 3. Where the proposed system complies fully, indicate by placing the word "comply" next to the subparagraph.
- 4. Where the proposed system does not comply or accomplishes the stated function in a manner different from that described, provide a full description of the deviation.
- 5. Each sheet of the submittal shall be sequentially numbered in the form of "Sheet x of y" where "x" is the sequential number of the sheet and "y" is the total number of the sheets in the submittal.

- I. A submittal which does not include a point-by-point statement of compliance as specified shall be rejected.

1.8 OPERATION AND MAINTENANCE MANUALS:

- A. Provide operating instruction and maintenance data manuals for materials and equipment as required by each section of the specifications.
- B. Submit an electronic copy of Operations and Maintenance Manuals in Portable Document Format (PDF) at least four weeks before substantial completion of the project.
 - 1. Confirm that all data and instruction sheets are marked to indicate the plan symbol, model, number, and options installed for each item of equipment furnished and installed. These data sheets are to be presented as reviewed and approved submittals, or shall be accompanied by such.
 - 2. Confirm that the serial numbers of each item of equipment installed are listed along with the model numbers and plan symbols.
 - 3. Additionally, confirm that the following information is included:

- a. A Table of Contents.
 - b. A complete parts list(s) and source of supply for each piece of equipment, marked with model, size, and plan symbol(s).
 - c. Copies of the approved submittals for each piece of equipment.
 - d. The balance report, when applicable.
 - e. Performance curves and capacity data, marked with model and size, in addition to plan, symbols.
 - f. Wiring diagrams, marked with model and size, in addition to plan, symbols.
 - 4. The following information is to appear on the front cover of the CD submittal:
 - a. "Operation and Maintenance Manual"
 - b. Project Name (and volume number, if manual consists of more than one volume)
 - c. Project number (the seven-digit University number)
 - d. Building name, number, and street address
 - e. "University of Utah"
 - f. Consultant's name
 - g. Applicable Sub-Consultant's name
 - h. General Contractor's name
 - i. Mechanical Contractor's name
 - 5. Require contact lists for each item with complete contact information, including addresses and phone numbers.
- C. Include complete cleaning and servicing data compiled in clearly and easily understandable form. Show serial numbers of each piece of equipment, complete lists of replacement parts, motor ratings, etc. Each unit shall have its own individual sheet.
- 1.9 RECORD DRAWINGS:
- A. Maintain on a daily basis a complete set of "Red-Lined Drawings", reflecting an accurate record of all work including addendums, revisions, and changes. Indicate precise dimensioned locations of all concealed work and equipment, including concealed or embedded conduit, junction boxes, etc. Record all "Red-Lined Drawing" information on a set of full sized prints of the contract drawings.
 - B. Certify the "Red Lined Drawings" for correctness. Indicate on each drawing the name of the general and electrical contractors with signatures of each representative responsible for the work.
 - C. The electrical engineering design firm will create record (as-built) drawings from the certified red-lined drawings; however, the general and electrical contractors retain the responsibility for the accuracy of the record drawings.
- 1.10 WARRANTY:
- A. Ensure that the electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes and is free from electrical defects. Without additional charge, replace or repair, to satisfaction of the owner's representative, except from ordinary wear and tear, any part of the installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance or as otherwise indicated in individual sections, but in no case less than one year. Warranty incandescent and fluorescent lamps only for a period of two months from the date of substantial completion.

- B. Provide complete warranty information for each item including beginning of warranty period, duration of warranty, names, addresses, and telephone numbers and procedures for filling a claim and obtaining warranty services. Written warranties and guarantees are to be submitted separately as:
 - 1. Originals bound in a binder clearly identified with the title, "WARRANTIES AND GUARANTEES," the project name, the project number, and the Contractor's business name.
 - 2. Electronic documents in *.pdf format.

PART 2 – PRODUCTS

2.1 SUBSTITUTION OF MATERIALS:

- A. Provide only specified products or products approved by addendum. Substitutions will be considered if two copies of the proposal is received at the architect's/engineer's office eight (8) working days prior to the bid day. Include in the proposal the specified and proposed catalog numbers of the equipment under consideration and a catalog cut sheet(s) with pictorial and descriptive information. Certify that the equipment proposed is equal to that specified, that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents.
- B. It is the responsibility of the contractor to make all substituted equipment comply with the intent of the contract documents and bear all cost associated with conflicts arising from the use of substituted equipment.
- C. Provide samples if so required by the architect or engineer before or after bid day.

2.2 SPARE PARTS:

- A. Provide spare parts as specified in Divisions 26, 27, and 28 sections. Deliver all spare parts to owner's representative prior to substantial completion.

PART 3 – EXECUTION

3.1 GENERAL:

- A. Workmanship: Provide only first class workmanship from competent workers. Defective materials or workmanship will not be allowed on the project. Provide competent supervision for the work to be accomplished. Keep same foreman on the job, unless a change is authorized by the engineer.
- B. Coordination: Prior to construction, layout electrical work and coordinate work with other trades. Sequence, coordinate, and integrate installation of materials and equipment for efficient flow of the work. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. Coordinate the installation of electrical materials and equipment above ceilings

with suspension system, mechanical equipment and systems, and structural components. Coordinate with all utilities including power, communication, and data installations.

- C. Provide cutting, drilling, channeling, etc. only as necessary for proper completion of the work. Do not cut structural members unless authorization is issued in writing by the architect/engineer.
- D. Repairs: Repair damage to building, grounds, or utilities as a result of work under this contract at no additional cost to the owner.
- E. Dimensioning: Electrical drawings indicate locations for electrical equipment only in their approximate location, unless specifically dimensioned. Do not scale electrical drawings for dimensional information. Refer to architectural drawings and shop drawings where applicable for locations of all electrical equipment. Field verify all dimension on the job site.
- F. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.
- G. Standards: Provide electrical installation in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- H. All workmen doing work of any nature on State of Utah projects must at all times carry their electrician's license with them and show it upon request. The acceptable ratio of apprentice to journeyman electricians on the job is 1:1.

3.2 REQUESTS FOR INFORMATION:

- A. When it is clearly apparent that information is not adequately described in the construction documents or when a coordination problem exists, submit a request for information (RFI) through proper contractual channels. The electrical engineering design firm will provide a response through its contractual channel. Although verbal direction may be given to expedite changes, responses are not considered part of the contract documents until a change order has been issued and signed by the Owner or his designated representative. The Contractor shall bear all costs associated with proceeding on any change order that has not been approved by the Owner or his designated representative.
- B. Any damages caused by construction delays due to frivolous RFI's, will be born solely by the Contractor.

3.3 SAFETY PRECAUTIONS:

- A. Provide all necessary guards or construction barriers and take all necessary precautions to insure the safety of life and property.

3.4 CLEAN:

- A. Clean up all equipment, conduit, fittings, wire, packing cartons, plastic, and other debris that is a direct result of the installation of the work of this division, both during the execution, and at the conclusion, of the project. Keep the site clean and safe during the progress of the work.

Clean fixtures, interior and exterior of all equipment, and raceways prior to final acceptance. Vacuum interior of all electrical panels and equipment. Correct any damaged equipment. Touch-up or repaint if necessary.

3.5 TEMPORARY POWER:

- A. Make arrangements with the proper institution authority for all temporary electricity.
- B. Provide temporary power, complete with metering and wiring for lighting and power outlets for construction tools and equipment. Report the initial meter reading to the owner/institution, or otherwise as may be directed.
- C. Service shall be provided with a main disconnect and all 20 ampere receptacles protected by 20 amp GFI, single-pole breakers. No attempt is made herein to specify construction power requirements for equipment in detail. Provide all electrical equipment and wiring as required.
- D. As soon as permanent power and metering is available, the temporary power supply shall be disconnected and removed from the project site.
- E. All temporary wiring shall meet the requirements of NEC Article 305 and the State Industrial Commission.

3.6 POWER OUTAGES:

- A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the owner. Any electrical service interruption will be coordinated at least 7 days in advance of the power shut-off. Include all costs for overtime work in bid. Coordinate all outages and proceed only after receiving authorization from the owner's representative. Keep all outages to an absolute minimum.

3.7 STORAGE AND PROTECTION OF MATERIALS:

- A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. Lost or damaged materials will be replaced at no additional cost to owner. Do not store materials and apparatus in any public thoroughfare or in any area on the site where such storage would constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

3.8 EXCAVATING FOR ELECTRICAL WORK:

- A. Verification: Prior to excavating, locate and protect existing utilities and other underground work in a manner which will ensure that no damage or service interruption will result from excavating and backfilling. Observe all State and Local codes prior to excavating. Do not disturb walls, footings, and other structural members in any way.
- B. Protection: Provide barricades, warning signs, and illumination to protect persons from injury at excavations. Provide temporary coverings and heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install electrical work on frozen excavation bases or subbases.
- C. Coordination: Do not excavate for electrical work until the work is ready to proceed without

delay.

- D. Excavated Materials: Temporarily store excavated materials near excavation in manner which will not interfere with or damage excavation or other work. Dispose of and remove excavated materials which are either in excess of quantity needed for backfilling or do not comply with the requirements for backfill material.
- E. Burial Depths: Burial depths must comply with NEC Section 300-5 (or State of Utah requirements, whichever is more stringent), unless noted otherwise on drawings.
- F. Excavation Permits: Obtain all shut-down and excavation permits as may be required for proper completion of the work.

3.9 BACKFILL MATERIALS:

- A. For buried conduits or cables (other than below slab-on-grade, or concrete-encased), provide 2" thickness of well-graded sand on all sides of conduits or cables.
- B. For trench backfill to within 6" of final grade, provide soil material suitable for compacting to required densities.
- C. For top 6" of excavation, provide top soil.
- D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment:
 - 1. Lawn/Landscaped Areas: 85 percent for cohesive soils, 95 percent for cohesionless soils.
 - 2. Paved Areas, other than roadways: 90 percent for cohesive soils, 95 percent for cohesionless soils.
- E. Where subsidence is observable at electrical work excavations during project warranty period, remove surface, add backfill material, compact, and replace surface treatment. Restore surface to original condition.

3.10 ROOF PENETRATIONS:

- A. Where raceways and/or cables penetrate roofing, provide 26 gauge galvanized iron roof jack, sized to fit tightly to raceway and/or cable for weather-tight seal, and with flange extending a minimum of 9" under roofing on all sides. Seal opening between raceway and roof jack with approved sealant. Coordinate all work with division 7.

3.11 FIRE PENETRATION SEALS:

- A. Seal all raceway and/or cable penetrations through fire-rated floors, wall, and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. Provide penetration sealants and fittings of ratings to match the rating of the penetrated materials so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the NEC.
- B. Sealant Systems: Provide sealants, wall wraps, partitions, caps, and other accessories

complying with UL 1479 (ASTM E-814) from the following where applicable:

1. 3M Fire Barrier Sealing Penetration System
2. Chase Foam Fire Stop System
3. Thomas and Betts Flame Safe Fire Stop System
4. Nelson Fire Stop Products

- C. Fittings: Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry wall, floor, slabs, and similar structures.
- D. Install sealants and fittings in accordance with all manufacturer's written instructions.

3.12 LABELING:

- A. Engraved black plastic laminated, with white-core labels, 1/16" thick, shall be permanently attached on both the interior and exterior the following electrical equipment:
1. Branch panels
 2. Switchgear
 3. Disconnect switches
 4. Motor starter and controls junction boxes (power and auxiliary)
 5. Push buttons
 6. Thermal switches
 7. Time switches
 8. Similar equipment.
 9. Lighting contactors and associated switches
 10. Junction boxes larger than 4x4x1/2.
- B. The labels shall have 1/4" high, engraved letters, such as EF-1, AC-1, Panel A, etc.

3.13 HOUSEKEEPING PADS:

- A. Housekeeping Pads: Unless otherwise noted, provide 4" high reinforced concrete bases for all floor-mounted or floor-standing electrical equipment, including but not necessarily limited to the following:
1. Switchgear
 2. Generators
 3. Similar Equipment
- B. Extend bases 6" beyond equipment or mounting rails on all sides or as shown on the drawings. Notwithstanding this requirement, coordinate with equipment manufacturer, shop drawings, and height of base to ensure compliance with NEC 380-82.
- C. Transformer Vaults: Provide and locate properly sized concrete vaults for power company furnished pad mounted transformers in accordance with power company clearance requirements.

3.14 TESTS:

- A. Notify engineer prior to all testing specified herein at least three business days prior to testing.

Engineer shall observe all tests to insure the proper operation of the electrical system.

3.15 PROJECT FINALIZATION AND START-UP:

- A. Upon completion of the work, have each factory representative and/or subcontractor assist in start-up and testing of their respective systems.
- B. Have each representative give personal instructions on operating and maintenance of their equipment to the owner's maintenance and/or operation personnel.
- C. Have representatives certify each system with a written statement indicating that they have performed start-up and final check out of their respective systems.

3.16 FINAL REVIEW:

- A. Have the project foreman accompany their reviewing parties and remove coverplates, panel covers, access panels, etc. as requested, to allow review of the entire electrical system.

END OF SECTION 260001

SECTION 260070 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to electrical connections.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical connections for equipment include all final electrical connections for all equipment having electrical requirements including, but not necessarily limited to the following:
 - 1. Equipment specified under all divisions of the contract. Refer to other divisions for specific electrical requirements.
 - 2. Owner-furnished equipment.

1.3 QUALITY ASSURANCE:

- A. STANDARDS: Refer to Section 260001 – Electrical General Provisions as applicable.
- B. SHOP DRAWINGS: Not required.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. Provide all materials for electrical connections including, but not necessarily limited to the following:
 - 1. Raceways
 - 2. Fittings
 - 3. Conductors
 - 4. Cords
 - 5. Cord caps
 - 6. Wiring devices
 - 7. Pressure connectors
 - 8. Lugs (CU-AL)
 - 9. Electrical insulating tape
 - 10. Heat-shrinkable tubing
 - 11. Cable ties
 - 12. Wire nuts
 - 13. Other items and accessories as required.

- B. Crimp on or slip-on type splicing materials designed to be used without wire stripping are not acceptable.
- C. Power Distribution Blocks: Provide Square D Type LB or Equivalent.
- D. Refer to other Division 26, 27, and 28 Sections for specification of electrical materials as applicable.

PART 3 – EXECUTION

3.1 GENERAL:

- A. Make electrical connections in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 CONNECTIONS:

- A. Permanently Installed Fixed Equipment:
 - 1. Install conductors in flexible conduit from junction box to equipment control panel or connection point.
 - 2. Where such installations are subject to moisture, install in liquid-tight flexible conduit.
- B. Movable equipment:
 - 1. Provide wiring devices, cord caps, and multi-conductor cables as required.
- C. Other methods as required by the NEC and/or as required by special equipment or field conditions.
- D. Power Distribution Blocks: Unless noted otherwise on drawings, provide power distribution blocks only for tapping of feeders and branch circuits. Locate in junction box or gutter in NEMA ratings to suit application.

3.3 MANUFACTURER'S INSTRUCTIONS:

- A. Obtain manufacturer's instruction and wiring diagram regarding electrical connections of each piece of equipment and provide connections in accordance therewith.

3.4 VERIFICATION OF LOAD CHARACTERISTICS:

- A. Verify electrical load characteristics of all equipment prior to rough-in. Review respective shop drawings of all other Divisions and Owner's equipment manuals. Report any variances from electrical characteristics noted in the contract documents to the Architect/Engineer prior to rough-in.
- B. Value of rough-in work, electrical equipment, etc. installed and/or purchased by the contractor not meeting equipment requirements shall be credited back to the owner.

END OF SECTION 260070

SECTION 260072 - ELECTRICAL SUPPORTS AND SEISMIC RESTRAINTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY:

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

1.3 DEFINITIONS:

- A. IBC: International Building Code.
- B. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.4 SUBMITTALS:

- A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.
 - 1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - 2. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a qualified professional engineer. Include the following:
 - 1. Fabricated Supports: Representations of field-fabricated supports not detailed on Drawings.
 - 2. Seismic Restraints: Detail anchorage and bracing not defined by details or charts on Drawings. Include the following:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods,

- and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.
 - c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
 - C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
 - D. Welding certificates.
 - E. Qualification Data: For professional engineer and testing agency.
 - F. Field quality-control test reports.
- 1.5 QUALITY ASSURANCE:
- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
 - B. Testing of Seismic Anchorage Devices: Comply with testing requirements in Part 3.
 - C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS:

- A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.
- B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.
 - 1. Available Manufacturers:
 - a. Cooper B-Line; a division of Cooper Industries.
 - b. ERICO International Corporation.
 - c. Allied Support Systems; Power-Strut Unit.
 - d. GS Metals Corp.

- e. Michigan Hanger Co., Inc.; O-Strut Div.
 - f. National Pipe Hanger Corp.
 - g. Thomas & Betts Corporation.
 - h. Unistrut; Tyco International, Ltd.
 - i. Wesanco, Inc.
 - 2. Finishes:
 - a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
 - 3. Channel Dimensions: Selected for structural loading and applicable seismic forces.
- C. Raceway and Cable Supports: As described in NECA 1.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. 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.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
- 1. Verify suitability of fasteners in subparagraph below for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.
 - 2. 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.
 - a. Available Manufacturers:
 - 1) Hilti, Inc.
 - 2) ITW Construction Products.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co. Inc.
 - 3. In the following subparagraph, use stainless steel anchors in corrosive environments.
 - 4. 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.
 - a. Available Manufacturers:
 - 1) Cooper B-Line; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc
 - 3) Hilti, Inc.
 - 4) ITW Construction Products.
 - 5) MKT Fastening, LLC.
 - 6) Powers Fasteners.
 - 5. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 6. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
 - 7. Toggle Bolts: All-steel springhead type.

8. Hanger Rods: Threaded steel.

2.3 SEISMIC-RESTRAINT COMPONENTS:

- A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.
 1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least five times the maximum seismic forces to which they will be subjected.
- B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.
- C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.
 1. Available Manufacturers:
 - a. Amber/Booth Company, Inc.
 - b. Loos & Co., Inc.
 - c. Mason Industries, Inc.
 2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
 3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
 4. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
 5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

2.4 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 Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 – EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for raceways as within 12 inches of coupling, fitting, and box, at each 90 degrees bend, minimum of two supports per ten foot run. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways: Install trapeze-type supports fabricated with steel slotted or other 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 single-bolt conduit clamps, or as otherwise required by an agency acceptable to authorities having jurisdiction.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION:

- A. Comply with NECA 1 for installation requirements, except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, raceways may be supported by openings through structure members, as permitted in NFPA 70.
- C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.
- D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 Spring-tension clamps.
 - 7. To Light Steel: Sheet metal screws.
 - 8. 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 by means that meet seismic-restraint strength and anchorage requirements.
- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- G. Do not drill or core cut holes for anchors or use powder-activated fasteners in post-tension

slabs, joists, and beams.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS:

- A. Comply with installation requirements in Division 5 Section "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.

3.4 CONCRETE BASES:

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and seismic criteria at Project.
- B. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so expansion anchors will be a minimum of 10 bolt diameters from edge of the base.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
 - 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 6. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 3 Section "Cast-in-Place Concrete."

3.5 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS:

- A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Restraint Cables: Provide slack within maximums recommended by manufacturer.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.6 FIELD QUALITY CONTROL:

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing: Test pullout resistance of seismic anchorage devices.

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Record test results.

END OF SECTION 260072

SECTION 260110 - CONDUIT RACEWAYS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to conduit raceways.

1.2 DESCRIPTION OF WORK:

- A. Extent of raceways is indicated by drawings and schedules.
- B. Types of raceways in this section include the followings:
 - 1. Rigid Metal Conduit
 - 2. PVC Externally Coated Rigid Steel Conduit
 - 3. Intermediate Metal Conduit
 - 4. Electrical Metallic Tubing
 - 5. Flexible Metal Conduit
 - 6. Liquid-tight Flexible Metal Conduit
 - 7. Rigid Non-metallic Conduit
 - 8. Electrical Non-metallic Tubing

1.3 QUALITY ASSURANCE:

- A. Standards: Refer to Section 260001 – Electrical General Provisions as applicable. Provide conduit raceway installation in accordance with recommendations of the American Iron and Steel Institute "Design Manual on Steel Electrical Raceways", latest edition.
- B. Manufacturers: Firms regularly engaged in the manufacture of raceway of types and sizes required, whose products have been in satisfactory service for not less than three (3) years.
- C. Shop Drawings: Not required.

PART 2 – PRODUCTS

2.1 CONDUITS:

- A. Rigid Metal Conduit (RMC): Provide zinc-coated, hot-dipped galvanized, rigid metallic conduit in accordance with Federal Specification WW-C-0581 and ANSI C80.1.
- B. PVC Externally Coated Rigid Metal Conduit: Provide hot-dipped galvanized, rigid metallic conduit externally coated with Polyvinyl Chloride (PVC) in accordance with ANSI C80.1 and

NEMA Std. Pub. No. RN 1.

- C. Intermediate Metal Conduit (IMC): Provide hot-dipped galvanized, intermediate metal conduit in accordance with Federal Specification WW-C-581.
- D. Electric Metallic Tubing (EMT): Provide electric metal tubing in accordance with Federal Specification WW-C-563 and ANSI C80.3.
- E. Flexible Metal Conduit: Provide zinc-coated, flexible metal conduit in accordance with Federal Specification WW-C-566.
- F. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight, flexible metal conduit, constructed of single strip, flexible continuous, interlocked, and double-wrapped steel, galvanized inside and outside, coated with liquid-tight jacket of flexible Polyvinyl Chloride (PVC).
- G. Rigid Non-Metallic Conduit: Provide rigid non-metallic conduit (PVC) in accordance with ANSI/NEMA TC 2, Type 1 for concrete encasement, Type 2 for direct burial.

2.2 FITTINGS:

- A. Rigid Metal Conduit, Intermediate Metal Conduit, and PVC Externally Coated Rigid Metal Conduit: Provide fully-threaded, malleable steel fittings, rain-tight and concrete-tight as applicable. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.
- B. Electric Metallic Tubing: Provide insulated throat, non-indenter, set screw, malleable steel fittings. Screws must have a full set. Provide concrete-tight compression-type fittings in suspended slabs. All EMT fittings shall be fabricated from steel. Die-cast fittings or fittings made from pot metal shall not be allowed. Indenter type fittings are not acceptable. Install OZ Type B bushings on conduits 1" and larger.
- C. Flexible Metal Conduit: Provide flexible metal conduit fittings in accordance with Federal Specification W-F-406, Type 1, Class 1, and Style A. Commercial "greenfield" not less than 1/2" diameter or as otherwise specified on drawings is acceptable.
- D. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit fittings in accordance with Federal Specification W-F-406, Type 1, Class 3, Style G.
- E. Non-Metallic Conduit: Provide non-metallic conduit fittings (PVC) in accordance with ANSI/NEMA TC 3 to match conduit types and materials.
- F. Expansion Fittings: OZ Type AX, or equivalent to suit application.
- G. Sealing Bushings: Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ Type CSB internal sealing bushings.
- H. Cable Supports: Provide OZ cable supports for vertical risers, type as required by application.

2.3 SIZES:

- A. Provide conduits in sizes as indicated in contract documents or as otherwise specified herein, but not less than 3/4".

CONDUIT RACEWAYS

260110 - 2

PART 3 – EXECUTION

3.1 GENERAL:

- A. Install raceway and accessories in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 LOCATIONS:

- A. Rigid Metal Conduit and Fittings: Use for conduit bends where buried below grade or slab on grade. Install RMC where raceway passes vertically through slab-on-grade. Where raceways penetrate building, manholes, or vault walls and floors below grade, provide RMC for a minimum distance of 10' on the exterior side of the floor or wall. Use RMC for exposed runs where conduit is subject to moisture, weather, or mechanical injury. Use in hazardous locations in accordance with all NEC requirements.
- B. Intermediate Metal Conduit and Fittings: Use for exposed runs where conduit is subject to moisture, weather, or mechanical injury. Use in hazardous locations in accordance with all NEC requirements.
- C. Electric Metal Tubing and Fittings: Use for above-grade feeders, branch circuits, and signal and control circuit, unless specifically noted otherwise on drawings. Install in suspended slabs subject to local code requirements and fire rating considerations.
- D. Flexible Metal Conduit and Fittings: Use as whips for lighting fixtures, fixed equipment where not exposed to weather or moisture, other devices where required by NEC, and as requested by the Engineer. Maximum length not to exceed 6', unless specifically approved by the Electrical Engineer.
- E. Liquid-Tight Flexible Metal Conduit and Fittings: Use for connection to motor terminal boxes, fixed equipment where subject to moisture or weather, and other equipment subject to movement or vibration. Maximum length not to exceed 6', unless specified otherwise.
- F. Rigid Non-Metallic Conduit and Fittings: Use for below-grade service entrances, feeders, branch circuits, and signal and control circuit, unless specifically noted otherwise on drawings. Do not use above grade.

3.3 METHODS:

- A. Maintain a minimum of 12" clearance between steam or hot water lines or other hot surfaces. Where such clearance is impractical, insulate conduit with approved materials.
- B. Install conduits parallel with or at right angles to lines of the structure. Route conduits symmetrically where possible.
- C. Field bends and offsets shall be made without flattening, kinking, rippling or destroying the smooth internal bore or surface of the conduit and to not less than NEC minimum radius. Conduit that shows signs of rippling or kinking shall not be installed. Conduits installed with

wrinkles or kinks or otherwise in an unworkmanlike manner shall be replaced at no additional cost to owner.

- D. Precaution shall be exercised to prevent accumulation of water, dirt or concrete in the conduits during the execution of the project. Conduits in which water or foreign matter has been permitted to accumulate shall be thoroughly cleaned or the conduits runs replaced where such accumulation cannot be removed by methods approved the engineer.
- E. Any conduit which pierces airtight spaces or plenums shall be sealed to prevent air leakage with mastic acceptable to the Architect.

3.4 CONCEALING:

- A. All raceways shall be concealed within the ceilings, walls, and floors, except in locations where exposed raceways are specifically permitted, such as equipment rooms and unfinished storage areas. In equipment rooms, if lighting raceways are run exposed, installation shall not be done until piping and duct work layout has been determined in order that lighting boxes may be located so as to avoid being covered by overhead ducts and piping. If lighting raceways in equipment rooms are concealed in the structural ceiling slab, after mechanical work is complete, exposed conduit extensions shall be run to locate lighting fixtures where they are not obscured by work of other trades.

3.5 BURIED CONDUITS:

- A. Comply with all burial depths as defined in NEC Section 300-5. Bury all conduits at least 24" below grade, unless specifically indicated otherwise on drawings. Provide magnetic 6" wide "Yellow Warning" ribbon 12" directly above conduit and 6" below finished grade measured from the top of the conduit or duct bank. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single marker.
- B. All buried conduit elbows shall be long-radius RMC, or fiberglass elbows
- C. Slope all conduits toward manholes or pull boxes for proper drainage. Use weep holes. Gravel drainage pockets are not permitted.
- D. Coat all metal conduits with an approved asphaltic compound or wrap with two layers of PVC tape.
- E. Under Concrete Slab on Grade: Horizontal conduit must be installed a minimum of 2" below the bottom of the concrete slab. Conduits should not be installed in concrete slabs.
- F. Where conduits are extended for future use, cap and clearly mark.

3.6 ELECTRICAL CONTINUITY:

- A. Provide electrically continuous conduit systems throughout.

3.7 FIELD CUTS AND THREADS:

- A. Cut all conduits square. Remove all sharp or rough edges and ream all burrs, inside and outside. Provide clean sharp threads on RMC and IMC.

- B. Engage at least five full threads on all RMC and IMC fittings. Before couplings or fittings are attached, apply one coat of red lead or zinc chromate to male threads of RMC or IMC. Apply coat of red lead, zinc chromate or special compound recommended by manufacture to conduit where conduit protective coating is damaged.

3.8 SUSPENDED SLABS:

- A. When conduit is installed in the suspended slab, it shall be limited to conduits having a diameter of 1" (25 mm) or less, or less than 1/3 the concrete cover, and no crossovers occur, and conduit spaced at least 18" (450 mm) apart with a 3/4" (20 mm) cover.

3.9 CONDUIT ENDS:

- A. Cap all spare conduits. Cap or plug conduit ends during construction to prevent entrance of foreign material.

3.10 SPARE CONDUITS:

- A. Provide five (5) 3/4" empty conduits from panel stubbed into accessible ceiling space and five (5) 3/4" conduits into accessible floor space. When floor is not accessible, provide six (6) 3/4" empty conduits from panel stubbed into accessible ceiling space. Cap and label all conduits.
- B. Install a 200 lb. polypropylene pull cord in each empty conduit run.

3.11 HAZARDOUS LOCATIONS:

- A. Install RMC and IMC in all hazardous locations as defined by the NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with all NEC requirements and/or as shown on the drawings. Provide inspection fittings with hazardous location rated drains to prevent water from accumulating in conduit runs.

3.12 CLEANING:

- A. Pull mandrel and swab through all conduits before installing conductors.

END OF SECTION 260110

SECTION 260120 - CONDUCTORS AND CABLES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to conductors and cables.

1.2 DESCRIPTION OF WORK:

- A. This section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.
- B. Types of conductors and cables in this section include the following:
 - 1. Copper Conductors.
- C. Applications for conductors and cables required for project include:
 - 1. Branch Circuits.

1.3 SUBMITTALS:

- A. Product Data: For each type of conductor and/or cable indicated.
- B. Field Quality-Control Test Reports: From Contractor. Refer to Section 260001 – General Electrical Provisions.

1.4 QUALITY ASSURANCE:

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. Manufacturers: In other Part 2 articles where subparagraph titles below introduce lists, provide products by the manufacturer specified, subject to compliance with requirements.

- B. Ambient Conditions: Conductors used for branch circuits in areas where the ambient conditions exceed 30 degree C. shall be provided with insulation approved for that temperature.
- C. Wire Sizes: As indicated on electrical drawings or as specified herein, but in no case less than No. 12 AWG.

2.2 COPPER CONDUCTORS:

- A. Manufacturers:
 - 1. Cerro Wire & Cable Company.
 - 2. General Cable Technologies Corporation.
 - 3. Encore Wire Corporation.
 - 4. Southwire Incorporated.
- B. Refer to Part 3 "Conductor and Cable Applications" Article for application requirements.
- C. References and Ratings:
 - 1. ICEA S-95-658 / NEMA WC70.
 - 2. ASTM.
 - 3. UL Standard 83.
 - 4. UL Standard 1063 (MTW).
 - 5. Federal Specification J-C-30B.
 - 6. NEC.
- D. Conductor Material: Copper.
- E. Stranding: Solid conductor for No. 12 AWG, stranded for No. 10 AWG and larger.
- F. Conductor Insulation Types: Thermoplastic-insulated, Type THHN / THWN-2.

2.3 ALUMINUM CONDUCTORS:

- A. Not allowed.

2.4 MC FLEXIBLE METAL CLAD COPPER CABLES:

- A. Not allowed.

2.5 CONNECTORS AND SPLICES:

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc.
 - 2. AMP Incorporated/Tyco International.
 - 3. Hubbell/Anderson.
 - 4. O-Z/Gedney; EGS Electrical Group LLC.
 - 5. 3M Company; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

- C. Splices for wire sizes #10 and smaller shall be screw-on type similar to scotch or ideal wing nut connectors. Crimp-on splices designed to be used without wire stripping are not acceptable.

PART 3 – EXECUTION

3.1 GENERAL:

- A. Install conductors, cables, and accessories as indicated, in compliance with manufacturer's written instruction, applicable requirements of NEC, NECA's "Standards of Installation", and in accordance with recognized industry practices to ensure that products fulfill requirements.

3.2 CONDUCTOR AND CABLE APPLICATIONS:

- A. Branch Circuits:
 - 1. Exposed, including in crawlspace: Copper conductors in raceway.
 - 2. Concealed in ceilings, walls, and partitions: Copper conductors in homerun raceways.
 - 3. Concealed in concrete and below slabs-on-grade: Copper conductors in raceway.
- B. Cord Drops, Reels, and Portable Appliance Connections: Flexible cord.
- C. Class 1 Control Circuits: Copper conductors in raceway.

3.3 INSTALLATION:

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. 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.
- C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. When raceway is not required, install concealed cables parallel and perpendicular to surfaces of structural members, and follow surface contours where possible.
- E. Support cables according to other applicable specification sections.
- F. Seal around cables penetrating fire-rated elements to comply with applicable fire stop specification sections.
- G. Color Coding: Color code secondary service, feeder, and branch circuit conductors. Colors shall remain consistent throughout the project and shall match existing coding system where applicable.
 - 1. Conductor sizes No. 6 AWG and smaller: Colored insulation.
 - 2. Conductors sizes No. 4 AWG and larger: 2 inch (51 mm) band of Colored adhesive marking tape applied at all terminations, junction boxes, and pull boxes.
 - 3. Branch circuit switched-legs and travelers: Colored insulation (in colors other than those

indicated below).

4. Color-code 120/208V system conductors:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral A: White with Black stripe.
 - e. Neutral B: White with Red stripe.
 - f. Neutral C: White with Blue stripe.
 - g. Ground: Green.
 - h. Isolated Ground: Green with yellow tracer.

3.4 HOMERUN CIRCUITS:

- A. Homerun circuits may be combined in common conduits at the option of the contractor in compliance with the following:
 1. Three-Phase Installations: Not more than three single-phase circuits in one conduit, unless specifically noted otherwise, if each circuit is from a different phase (a, b, or c).
 2. Single-Phase Installations: Not more than two single-phase circuits in one conduit, unless specifically noted otherwise, if each circuit is from a different phase (a or b).

3.5 NEUTRAL CONDUCTORS:

- A. NEW LINE-TO-NEUTRAL BRANCH CIRCUITS: Provide a dedicated neutral for each line-to-neutral branch circuit. Size the neutral conductor the same as the phase conductor. In each outlet or junction box containing multiple neutral conductors, tag each neutral to identify which circuit it serves.
- B. Meet all the requirements of the NEC Section 210.4, Multiwire Branch Circuits.

3.6 VOLTAGE DROP:

- A. Provide branch circuit conductors in sizes such that voltage drop for branch circuits do not exceed 3 percent at the farthest outlet. Provide service, feeder, and branch circuit conductors so that the voltage drop on the entire electrical system does not exceed 5 percent at the farthest outlet. This shall be strictly followed regardless of the conductor sizes indicated on the electrical drawings. Increase conductor sizes (and conduits where necessary to comply with NEC conduit fill requirements) as necessary to accommodate this requirement. Calculations shall be based on the following:
 1. Lighting Branch Circuits: Connected load plus 25% spare.
 2. Appliance and Equipment Branch Circuits: Nameplate or NEC required load.
 3. 120V Convenience Outlet Branch Circuits: 12 amps minimum, but in no case less than NEC loading requirements. Use the following schedule:

<u>Distance (feet)</u>	<u>Wire Size (AWG)</u>
0-80	#12
81-125	#10
126-200	#8
201-320	#6

4. Use the NEC method to calculate voltage drop.

3.7 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 and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- D. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack. Use pig tails when wiring outlets.

3.8 FIELD QUALITY CONTROL:

- A. Testing: Perform the following field quality-control testing:
 1. Visual and Mechanical Inspection:
 - a. Inspect cables for physical damage and proper connection in accordance with the electrical construction documents.
 - b. Test cable mechanical connections to manufacturer's recommended values with a calibrated torque wrench.
 - c. Check cable color coding for compliance with electrical specifications.
 2. Electrical Tests:
 - a. Perform insulation resistance test on each conductors for feeders 100 amps and greater with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for 1 minute.
 - b. Perform continuity test to insure proper cable connection.
 3. Test Values:
 - a. Minimum insulation resistance values shall not be less than two megaohms.
 4. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each new and existing splice or termination in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Test Reports: Prepare a written report and submit to the Electrical Engineer at the completion of the project. The report shall include the following:
 1. Test procedures used.

2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 260120

SECTION 260135 - ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to electrical boxes and fittings.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical boxes and fittings work is indicated by drawings and schedules.
- B. Types of electrical boxes and fittings in this section include the following:
 - 1. Outlet Boxes
 - 2. Junction Boxes
 - 3. Pull Boxes
 - 4. Floor Boxes
 - 5. Conduit Bodies
 - 6. Bushings
 - 7. Locknuts
 - 8. Knockout Closures
 - 9. Miscellaneous Boxes and Fittings

1.3 QUALITY ASSURANCE:

- A. Standards: Refer to Section 260001 – Electrical General Provisions as applicable.
- B. Manufacturers: Firms regularly engaged in the manufacturer of boxes and fittings required, whose products have been in satisfactory service for not less than three years.
- C. Shop Drawings: Submit shop drawings on floor boxes only where required.

PART 2 – PRODUCTS

2.1 INTERIOR OUTLET BOXES:

- A. General: Provide one piece, galvanized or cadmium-plated, flat-rolled, sheet steel interior outlet boxes of types, shapes, and sizes to suit respective location and installation. Construct with stamped knockouts on back and sides and with threaded screw holes. Provide corrosion-resistant screws for securing boxes, covers, and wiring devices. Size all junction boxes in accordance with NEC Table 314.16(A), with a minimum box size of 4" x 4" x 1-1/2". Where three raceway entries are made, provide outlet boxes with a minimum depth of 2-1/8". Where

four or more raceway entries are made, provide outlet boxes with a minimum depth of 4-11/16". Gangable boxes shall not be used.

- B. Switch, Telephone, and Receptacle Outlets: Provide outlet boxes not less than 4" square, with adapting tile or plaster covers where necessary to set flush with finished surfaces. Where three raceway entries are made, provide outlet boxes with a minimum depth of 2-1/8". Gang boxes shall be used where more than one switch or device is located at one point. Sectional Boxes are not acceptable. In masonry walls where tile or plaster ring cannot be used, install a single-gang 3-1/2" deep box minimum, unless otherwise noted. Where four or more raceway entries are made, provide outlet boxes with a minimum depth of 4-11/16".

C. Lighting Outlets:

- 1. Lay-in Grid: Outlets for recessed fixtures in acoustical tile ceilings shall be located to center on a single tile or at the intersection of four tiles.
- 2. Surface-mounted: Provide 4" square octagonal outlet boxes for surface-mounted, ceiling fixture outlets. Mount each box independently of the conduit on standard 3/8" stud or approved box hanger where applicable. Include backing and supports as required to carry 200 lbs. Where three or more raceway entrances are made, use a minimum box depth of 2-1/8".

2.2 WEATHERPROOF OUTLET BOXES:

- A. Provide corrosion-resistant, cast-metal weatherproof outlet boxes, of types, shapes, and sizes, with threaded conduit ends, cast metal coverplates with spring-hinged waterproof caps, face plate gaskets, and corrosion-resistant fasteners.

2.3 JUNCTION AND PULL BOXES:

- A. Provide code-gauge sheet steel junction and pull boxes, with removable screw-on covers and welded seams, of types, shapes, and sizes to suit each respective location and installation. Size all junction and pull boxes in accordance with NEC 314.28. Provide stainless steel nuts, bolts, screws, and washer.

2.4 FLOOR BOXES:

- A. Provide steel, weatherproof, concrete-tight floor boxes of types, shapes, and sizes to suit each respective location and installation. Where multi-service floor boxes are indicated, provide floor boxes sized to accommodate wiring devices and communication outlets shown on drawings. Construct floor boxes with fully adjustable leveling screws, and knockouts as required to accommodate specified conduits.

- B. Provide floor boxes from the following manufacturers:

- 1. Bell Electric
- 2. Crouse-Hinds
- 3. Hubbell
- 4. Steel City
- 5. Thomas&Betts
- 6. Wiremold

2.5 CONDUIT BODIES:

- A. Provide galvanized, cast-metal conduit bodies of type, shapes, and sizes to suit respective locations and installation. Construct with threaded conduit entrance ends and removable covers. Provide corrosion-resistant screws.
- B. Aluminum boxes and fitting shall not be permitted.

2.6 CONDUIT CONNECTIONS:

- A. Box connectors 3/4" and larger shall be insulated, throat-type or equal type plastic bushings. Provide double locknuts and insulating plastic bushings for RMC and IMC terminating at panels and boxes.
- B. Where RMC penetrates building, manholes, or vault walls and floors below grade, provide sealing bushings with external membrane clamps as applicable. Provide segmented internal sealing bushings in all raceways penetrating building walls and slabs below grade, and in all above grade raceway penetrations susceptible to moisture migration into building through raceway. Where RMC terminates in manhole, vault, or pull box, provide insulated grounding bushings. Also see Section 260135 – Electrical Boxes and Fittings.
- C. Install OZ type "B" connectors for all conduits 1" and larger.
- D. Provide cable supports in all vertical risers in accordance with NEC 300-19.

2.7 EXPANSION FITTINGS:

- A. Provide expansion joint fittings in all conduit runs crossing structural expansion joints, whether above-grade, in slab-on-grade, or in suspended slabs. Provide OZ type "AX" or approved equivalent, size to the raceway.

2.8 ACCESSORIES:

- A. Provide all accessories including, but not necessarily limited to, bushings, knockout closures, locknuts, offset connectors, etc. of types, shapes, and sizes to suit respective locations and installation. Construct of corrosion-resistant steel.

PART 3 – EXECUTION

3.1 GENERAL:

- A. Install electrical boxes and fittings in accordance with manufacturer's written instruction, applicable requirements of the NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 METHODS:

- A. Where outlet boxes are subject to weather or moisture, install weatherproof outlet boxes.

- B. Remove knockouts only for entering conduits. Provide knockout closures to cap unused knockout holes where blanks are mistakenly removed.
- C. Do not use condulets in place of elbows or junction boxes. Condulets in sizes 2" or larger shall not be used, unless specifically approved by the electrical engineer.
- D. Install boxes and conduit bodies in readily accessible locations. Install recessed boxes with faces of boxes or rings flush with finished surfaces. Seal all openings between outlet box and adjacent surfaces with plaster, grout, or similar suitable material.
- E. For stud construction, install boxes with rigid supports using metal bar hangers, or 2" X 4", 1" X 6" wood bridging between studs with screws. Welding or nailing boxes directly to metal joist and studs is not acceptable. Boxes set opposite in common wall shall have at least 10" of conduit between them. Securely fasten outlet boxes to structural surfaces to which attached.
- F. For concrete or masonry construction, solidly embed electrical boxes in concrete and masonry. Provide box supports as required to keep outlet boxes flush with finished surfaces.
- G. Coordinate location of all outlet boxes with millwork, back splashes, tackboards, etc.
- H. Install junction boxes or condulets in conduit runs as required at 100 foot maximum intervals on long runs. This shall apply to concrete junction boxes in grade and junction boxes within the building.
- I. Provide electrical connections for installed boxes.

3.3 IDENTIFICATION:

- A. Mark circuit number on exterior side of junction boxes located in ceilings such that circuit numbers are readily identifiable. For outlet boxes in wall, mark circuit numbers on interior sides of outlet boxes.
- B. Identification labels shall be as follows:

Normal Power	Black with White letters
--------------	--------------------------

END OF SECTION 260135

SECTION 260140 - WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to wiring devices.

1.2 DESCRIPTION OF WORK:

- A. Extent of wiring device work is indicated by drawings and schedules.
- B. Types of electrical wiring devices in this section include the following:
 - 1. Toggle Switches
 - 2. Receptacles
 - 3. Transient Voltage Surge Suppression (TVSS) Receptacles
 - 4. Floor Service Outlets
 - 5. Poke-Through Assemblies
 - 6. Dimmers
 - 7. Special Purpose Outlets
 - 8. Multioutlet Assemblies
 - 9. Cord Caps and Connectors
 - 10. Low Voltage Lighting Control Devices

1.3 QUALITY ASSURANCE:

- A. STANDARDS: Refer to Section 260001 – Electrical General Provisions as applicable.
- B. SHOP DRAWINGS:
 - 1. Submit manufacturer's data on all electrical wiring devices.
 - 2. Where occupancy sensors are required, provide scaled drawing showing manufacturer's recommended locations.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA standards Pub No. WD 1. nylon construction, 20 amp rating minimum.

- B. Provide wiring devices in colors selected by Architect/Engineer. Provide red receptacle outlets and toggle switches where devices are circuited to emergency power. Provide orange receptacle outlets where devices are circuited to standby power.

2.2 TOGGLE SWITCHES:

- A. Provide toggle switches from one of the following manufacturers (Fed-Spec):

Manufacturer

Hubbell
Pass & Seymour
Leviton
Cooper
Bryant

- B. Abbreviations are defined as follows:

1. 1-Pole - Single-Pole Toggle Switch
2. 3-Way - Three-Way Toggle Switch
3. 4-Way - Four-Way Toggle Switch
4. W/Pilo - Single-Pole Toggle Switch with Pilot Light

- C. Must be back and side wired, and have color-coded covers, Brass terminal screws, back wire ground clamp, and self-grounding clip.

2.3 RECEPTACLES:

- A. Provide duplex receptacles from one of the following manufacturers:

Manufacturer

Hubbell
Pass & Seymour
Leviton
Cooper
Bryant

- B. Must have one-piece Brass back strap and back wire grounding clamp (Does not apply to GCFI or isolated ground).

2.4 FLOOR SERVICE OUTLETS:

- A. Provide all receptacles and special purpose outlets required in floor boxes. See Section 260135 – Electrical Boxes and Fittings. Provide coverplates, carpet flanges, etc. in finishes or colors selected by Architect/Engineer.

2.5 POKE-THROUGH ASSEMBLIES:

- A. Provide factory-assembled, poke-through assemblies equipped with wiring devices as specified herein. Construct of materials to maintain fire rating of suspended slab with pre-wired conduit,

fire barriers, toggle arm assemblies, service fittings, integral junction box, etc. Provide coverplates, carpet flanges, etc. in finishes or colors selected by Architect/Engineer. Provide Poke-through assemblies of one of the following:

1. Hubbell
2. Thomas&Betts
3. Wiremold

2.6 SPECIAL PURPOSE OUTLETS:

- A. Provide special purpose outlets of voltage and ampere ratings, and NEMA configurations to suit respective application. Refer to drawings for NEMA configuration. Provide special purpose outlets in amperages at least as large as the overcurrent protective device from which they are served.

2.7 MULTI-OUTLET ASSEMBLIES:

- A. Provide multi-outlet assemblies with 15A, grounding-type, receptacle outlets spaced at 6" on centers and in colors selected by Architect/Engineer or as otherwise noted on drawings. Provide multi-outlet assemblies of one of the following:
 1. Wiremold
 2. Thomas&Betts
 3. Hubbell

2.8 CORD CAPS AND CONNECTORS:

- A. Provide cord caps and connectors of voltage and ampere ratings, and NEMA configurations which mate and match with outlets specified as required for final connections for equipment. Provide cord caps and connectors of one of the following:
 1. Hubbell
 2. Pass & Seymour
 3. Leviton
 4. Cooper
 5. Bryant

2.9 COVERPLATES:

- A. Wall Plates: Provide coverplates for all wiring devices. In all finished areas, provide nylon or high impact resistant thermoplastic coverplates in colors as selected by Architect. Provide red coverplates for all receptacle outlets and toggle switches that are circuited to emergency power. Provide orange coverplates for all isolated ground receptacle outlets. Provide ganged coverplates for all switches and/or dimmers. Provide pre-marked coverplates for special purpose outlet indicating voltage, amperages, and phase. Provide raised stamped, galvanized, steel plates in all unfinished areas and bus storage. Provide weather-proof coverplates for outlets exposed to weather and moisture.
- B. Weather-Protecting Device Enclosure: Where required for compliance with NEC 410-67 (receptacles installed outdoors for use other than with portable tools or equipment), provide weather-tight device covers which provide complete protection with the cord and cap inserted

into the wiring device. Provide units which mount on either single or double gang devices. Provide device enclosures manufactured by one of the following:

1. Intermatic WP1020 or WP1030
2. Hubbell WP826MP
3. Pass & Seymour

2.10 LOW VOLTAGE LIGHTING CONTROL DEVICES:

- A. General: Provide low voltage wall switches and dimmers, graphics wall stations, power packs, occupancy and vacancy sensors, and day-light photocell sensors as required for sensor based (occupancy, vacancy and day-light) and manual lighting control. Provide devices from one of the following manufacturers:

1. nLight
2. Watt Stopper
3. Cooper Controls

All substitutions must be submitted in writing for prior approval at least 7 days prior to last addendum. Proposed substitute products must be documented with a line by line compliance review, wiring diagrams, etc.

- B. Shop Drawings: Provide data sheets and wiring diagrams for all typical rooms and areas. Provide scaled ceiling drawings indicating exact placement of occupancy sensors. Drawings shall indicate proximate locations to mechanical diffusers, sprinkler heads, fire alarm devices, etc.
- C. Warranty: Provide five (5) year 100% parts replacement warranty.
- D. Wall Switches and Dimmers:
1. Devices shall recess into single-gang switch box and fit a standard GFI opening.
 2. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
 3. All devices shall have two RJ-45 ports.
 4. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
 5. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
 6. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
 7. Devices with mechanical push-buttons shall be made available with custom button labeling
 8. Devices with a single "on" button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.
 9. Provide nLight nPODM series or approved equal wall stations.
- E. Graphic Wall Stations:
1. Device shall have a 3.5" full color touch screen for selecting up to 16 programmable lighting control preset scenes or acting as up to 16 on/off/dim control switches.
 2. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).

3. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.
4. Device shall enable user supplied .jpg screen saver image to be uploaded.
5. Device shall surface mount to single-gang switch box.
6. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply.
7. Device shall have a micro-USB style connector for local computer connectivity.
8. Device shall have two RJ-45 ports for communication
9. Provide nLight nPOD GFX or approved equal graphics wall station.

F. Power Packs:

1. Power Packs shall incorporate one Class 1 relay, a 0-10 VDC dimming output, and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power.
2. Power Packs shall accept 120 or 277 VAC, be plenum rated, and provide Class 2 power to the system.
3. All devices shall have two RJ-45 ports.
4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
6. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
7. Power Packs shall be available that are WiFi enabled.
8. Power Packs shall be available that provide up to 5 Amps switching of all lighting load types as well as 0-10 VDC dimming LED drivers.
9. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
10. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120/277 VAC magnetic low voltage transformers.
11. Specific Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.
12. Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.
13. Specific Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
14. Power (Secondary) Packs shall be available that provide up to 20 Amps switching of general purposed receptacle (plug-load) control.
15. Provide nLight nPP16, nEPP5, nEPP5 series. or approved equal power packs.

G. Occupancy Sensors, Vacancy Sensors and Day-light Photocell Sensors:

1. All sensors shall be dual technology sensors. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
2. All sensing technologies shall be acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
3. Sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).
4. Sensors shall be available with one or two occupancy “poles”, each of which provides a programmable time delay.
5. Sensors shall be available in multiple lens options which are customized for specific applications.
6. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
7. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.
8. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue
9. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
10. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
11. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
12. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.
13. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
14. Wall switch sensors shall have optional features for photocell/daylight override, and low temperature/high humidity operation.
15. Wall switch sensors shall be available in four standard colors (Ivory, White, Light Almond, Gray)
16. Wall switch sensors shall be available with optional raise/lower dimming adjustment controls.
17. Provide nLight nWSX series or approved equal occupancy and vacancy sensors.

H. Day-light Photocell Sensors:

1. Photocell dimming sensor’s set-point and deadband shall be automatically calibrated through the sensor’s microprocessor by initiating an “Automatic Set-point Programming” procedure. Min and max dim settings as well as set-point may be manually entered.
2. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

3. Provide nLight nCM, nRM, and nES or approved equal day-light photocell sensors.

PART 3 – EXECUTION

3.1 GENERAL:

- A. Install wiring devices and accessories in accordance with manufacturer's written instruction, applicable requirements of the NEC, NEMA Standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to insure that products fulfill requirements.

3.2 METHODS:

- A. Install wiring devices only in electrical boxes which are clean and free from excess building materials, dirt, and debris. Do not install wiring devices until painting work is completed.
- B. Replace receptacles and/or coverplates which are damaged, stained, or burned.

3.3 GFCI RECEPTACLES:

- A. Provide separate neutral conductor from panel to each GFCI receptacle circuits.
- B. Install GFCI receptacles for all receptacles installed in restrooms, outdoors, or within six feet of any sink. All receptacles in kitchens shall be GFCI protected.
- C. Do not wire standard receptacles on the load side of GFCI receptacle - Install GFCI receptacles.

3.4 DIMMERS:

- A. Provide separate neutral conductor for each phase of the branch circuit on which dimmers are installed.
- B. Provide dimmers in wattage ratings that will support the maximum potential wattage of the fixtures that are being dimmed. Do not size dimmers based on actual lamps installed in light fixtures, but on maximum lamp wattage ratings of light fixtures on that particular circuit.

3.5 SURFACE RACEWAYS:

- A. Provide all receptacles and special purpose outlets required in surface raceways. See Section 260110 – Conduit Raceways, and Section 260135 – Electrical Boxes and Fittings.

3.6 OCCUPANCY SENSORS:

- A. Do not locate immediately adjacent to air diffusers. Coordinate exact placement with Divisions 21, 22, and 23.

3.7 GROUNDING:

- A. Provide electrical continuous, tight, grounding connections for wiring devices.

3.8 TESTING:

- A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

3.9 IDENTIFICATION:

- A. All devices shall be identified on the coverplate with panelboard name and circuit number.
- B. In each outlet, tag each wire to identify the circuit it serves.
- C. Identification labels shall be as follows:

Normal Power	Black with white letters
Emergency Power	Red white letters
Standby Power	Orange with black letters

END OF SECTION 260140

SECTION 260180 - OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 section making reference to overcurrent protective devices.

1.2 DESCRIPTION OF WORK:

- A. Extent of overcurrent protective devices is indicated by drawings and schedules and is specified herein.
- B. Type of overcurrent protective devices in this section include the following:
 - 1. Molded Case Circuit Breakers
 - 2. Fuses

1.3 QUALITY ASSURANCE:

- A. STANDARDS: Refer to Section 260001 - Electrical General Provisions as applicable.
- B. SUBMITTALS:
 - 1. SHOP DRAWINGS: Submit manufacturer's data on overcurrent protective devices including specifications, time-current trip characteristics curves, mounting requirements, installation instructions, etc. Submit dimensioned drawings of overcurrent protective devices.
 - 2. Equipment Room Layouts: Submit dimensioned drawings of all equipment rooms indicating spatial relationships to other proximate equipment. Insure that all code required clearances are maintained.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. Provide overcurrent protective devices and ancillary components of types, sizes, ratings, and electrical characteristics indicated. Provide enclosures in NEMA ratings as indicated and suitable for applications.

2.2 MOLDED CASE CIRCUIT BREAKERS:

- A. MANUFACTURERS: Match existing panelboards.

B. MOLDED CASE CIRCUIT BREAKERS:

1. Provide factory-assembled, molded case circuit breakers as integral components of lighting and appliance panelboards, power panelboards, switchboards, and for individual mounting as indicated. Provide thermal magnetic, molded case circuit breakers of amperages, voltages, types, and short circuit current ratings indicated. Provide bolt-on type breakers only. Construct with quick-break, quick-break mechanism with inverse-time delay and instantaneous trip protection for each pole. Provide breakers rated for ambient temperatures to suit respective applications. Provide mechanical screw type removable copper connector lugs of size to accommodate conductors specified.
2. Provide breakers that have interrupting ratings greater than or equal to the specified fault current. Provide fully-rated systems only. Series-rated systems are not acceptable, unless specifically noted otherwise.

2.3 FUSES:

A. VENDORS: Subject to compliance with all requirements, provide fuses from one of the following:

1. Bussmann
2. Gould Shawmut
3. Reliance
4. Littlefuse

B. FUSES: Provide fuses as integral components of disconnects, fusible switches, and bolted pressure switches. Provide fuses in types and sizes as recommended by manufacturer's written instructions. Provide fuses for mains, feeders, and branch circuits as follows:

1. Circuits 601 to 6000 amperes: Shall be protected by current limiting Bussmann Low-Peak Time-Delay Fuses KRP-C or equivalent. Fuses shall be UL Class L with an interrupting rating of 200,000 amperes r.m.s. symmetrical.
2. Motor and Transformer Circuits 0 to 600 amperes: Shall be protected by current-limiting Bussmann Low-Peak Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) or equivalent. Fuses shall be UL Class RK1 with an interrupting rating of 200,000 amperes r.m.s. symmetrical.
3. Feeders to Circuit Breaker Panels 0 to 600 amperes: Shall be protected by current-limiting Bussmann Low-Peak Time Delay fuses LPJ or equivalent. Fuses shall be UL Class RK1 with an interrupting rating of 200,000 amperes r.m.s. symmetrical.

PART 3 – EXECUTION

3.1 GENERAL:

- A. Install overcurrent protective devices in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 SIZING FUSES:

OVERCURRENT PROTECTIVE DEVICES

260180 - 2

- A. Size all fuses in accordance with manufacturer's written recommendations, whether fuse size is indicated on drawings or not. If nuisance tripping occurs, increase fuse size and disconnect if necessary as required to provide nuisance-free tripping. Adjust fuse size for proper ambient temperature, frequent starting and stopping of motor loads, and for loads with long start times.

3.3 IDENTIFICATION:

- A. Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of each disconnect indicating name of disconnect or load served. Bolt labels to enclosure. Mark on interior cover the source of power by indicating the panel and circuit number.
- B. Provide red plastic laminate label with white letters for disconnects supplied by emergency power.
- C. Provide orange plastic laminate label with black letters for disconnects supplied by standby power.

3.4 MOUNTING:

- A. Mount disconnects as indicated, but in no case higher than 6'-6" from finished floor to top of disconnect. Anchor enclosures firmly to walls and structural surfaces.

3.5 SETTINGS:

- A. Adjust settings of overcurrent protective devices as directed by engineer.

3.6 SPARE PARTS:

- A. Spare Fuses: For each type and ampere rating, furnish one spare fuse for every 5 provided, but not less than three total.
- B. Fuse Cabinets: Furnish and install fuse cabinet(s) in quantities as required, but in no case less than one, to house the spare fuses indicated above. Locate in main electrical room as directed by the Electrical Engineer.

END OF SECTION 260180

SECTION 260452 - GROUNDING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to grounding.

1.2 DESCRIPTION OF WORK:

- A. Extent of grounding work is indicated by drawings and schedules and is specified herein.
- B. Ground the complete electrical installation including the system neutral, metallic conduits and raceways, boxes, fittings, devices, cabinets, equipment, and separately derived systems in accordance with the NEC and all other applicable codes to provide a permanent, continuous, low impedance, grounding system.
- C. Provide grounding system such that the resistance from the service entrance ground bus, through the grounding electrode to earth is not greater than 5 ohms.

1.3 QUALITY ASSURANCE:

- A. STANDARDS: Refer to Section 260001 – Electrical General Provisions as applicable.
- B. TESTING: Submit results of ground resistance testing as specified in this section. Include name of testing agency with report. Include test results in operation and maintenance manuals.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. Provide grounding equipment and accessories of types, sizes, ratings, and electrical characteristics indicated or as otherwise required to provide a complete system.

2.2 GROUNDING CONDUCTORS:

- A. Unless noted otherwise, provide grounding conductors with stranding and insulation types to match phase conductors. Provide conductors with green insulation if possible; otherwise wrap with green tape. Size ground conductors as indicated on drawings. Do not size ground conductors smaller than that allowable by NEC.

2.3 GROUND RODS:

- A. Provide copper clad, steel, 3/4" diameter by 10' long, ground rods (Weaver, Cadweld, or equivalent).

2.4 TEST WELLS:

- A. Provide precast concrete box 9-1/2" W. x 16" L. x 18" D. with light duty concrete cover for non-traffic areas or rated steel plate for traffic areas. Provide covers with lifting holes. Engrave cover with "Ground Rod".

2.5 CONCRETE ENCASED GROUNDING ELECTRODE (UFER GROUND):

- A. Provide a bare copper conductor encased along the bottom of concrete foundation or footing that is in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. Size UFER ground conductor in accordance with the NEC. Extend conductor through a horizontal length of 30' minimum and encase with not less than 2 nor more than 5 inches of concrete separating it from surrounding soils.

2.6 INSULATED GROUNDING BUSHINGS:

- A. Provide plated malleable iron body with 150 degree Centigrade molded plastic insulating throat, lay-in grounding lug with hardened stainless steel fasteners (OZ Gedney BLG or equivalent).

2.7 CONNECTION TO PIPES:

- A. Provide heavy duty, cast bronze, ground clamp systems with silicon bronze bolts and nuts (OZ Gedney G Series - B or equivalent).

2.8 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES:

- A. Provide exothermic welds. (Cadweld or equivalent)

2.9 BONDING JUMPERS:

- A. Provide bonding jumpers with hot dip galvanized malleable or ductile iron clamps, hot dip galvanized steel U-bolts, and tinned copper braids (OZ Gedney BJ Series or equivalent).

2.10 GROUND BUS:

- A. Provide 1/4" x 4", copper ground bus complete with insulators and brackets in lengths and at mounting heights as indicated on drawings. Furnish complete with drilled holes and lugs to accommodate grounding conductors.

PART 3 – EXECUTION

3.1 GENERAL:

- A. Install grounding systems in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 CLEANING:

- A. Thoroughly clean all metal contact surfaces prior to installation of clamp-on connectors.

3.3 SEPARATELY DERIVED SYSTEMS:

- A. Ground each separately derived system in accordance with NEC Section 250-16 unless otherwise indicated on drawings.

3.4 SERVICE ENTRANCE GROUNDING:

- A. Connect the following items using NEC sized copper grounding conductors (in NEC sized, conduits if concealment is required) to lugs on the service ground bus:
 - 1. Conductor from the UFER ground.
 - 2. Conductor from two ground rods driven exterior to building at not less than 10' apart.
 - 3. Conductor from main incoming cold water piping system.
 - 4. Conductor from building structural steel.
 - 5. Conductor from separately derived systems.
 - 6. Conductor from insulated ground bushings on service entrance conduits.
 - 7. Additional ground rods as required to achieve resistance value specified.
 - 8. Additional items indicated on drawings.

3.5 EQUIPMENT BONDING AND GROUNDING:

- A. Provide an NEC sized conductor, whether indicated or not on the drawings, in raceways as follows:
 - 1. Non-metallic conduits and ducts.
 - 2. Distribution feeders.
 - 3. Motor and equipment branch circuits.
 - 4. Device and lighting branch circuits.
 - 5. Full length of all multi-outlet assemblies and other surface wireways.

3.6 ADDITIONAL GROUNDING INSTALLATION REQUIREMENTS:

- A. Provide grounding bushings on all service conduit and conduits installed in concentric/eccentric knock-outs or reducing washer at panelboards, cabinets, and gutters.
- B. Provide bonding jumpers across expansion and deflection couplings in conduit runs, across pipe connections at water meters, and across dielectric couplings in metallic cold water piping system. Connection to water piping system shall be made electrically continuous by connecting to the street side of the water main valve and/or installing additional bonding jumpers across the meter, valves or service unions that might be disconnected.
- C. Provide bonding wire in all flexible conduits.
- D. Isolated Ground Circuits: Circuits used for isolated ground outlets shall be run in separate raceways or shall have a separate green insulated ground conductor installed and tagged for identification at all outlet and junction boxes.

3.7 TEST WELLS:

- A. All ground rods shall be driven external to building and shall be located in ground well boxes. Locate in landscaped areas where possible.

3.8 TESTING:

- A. Obtain and record ground resistance measurements both from service entrance ground bus to the ground electrode and from the ground electrode to earth. Install additional bonding and grounding electrodes as required to comply with resistance limits specified under this Section. Use independent testing agency for all testing.

END OF SECTION 260452

SECTION 260510 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.
- B. This section is a Division 26 General Provisions section, and is part of each Division 26, 27, and 28 sections making reference to interior and exterior building lighting.

1.2 SUMMARY

- A. This section provides general requirements for a complete and fully operational lighting system including:
 - 1. Interior lighting fixtures
 - 2. Accessories.
 - 3. Light fixture support.
- B. Extent of interior and exterior building lighting work is indicated by drawings and schedules and is specified herein.
- C. Type of lighting fixtures in this section include the following:
 - 1. Lighting Emitting Diode (LED)
- D. Related Sections:
 - 1. Section 260135, "Wiring Devices" for low voltage lighting control devices.

1.3 REFERENCES

- A. Conform to Reference Standards by date of issue current on date of Contract Documents, except where a specific date is established by code.
 - 1. ANS/NFPA 70 National Electrical Code
 - 2. NFPA 101 Life Safety Code
 - 3. UL 57 Electrical Luminaires
 - 4. UL 924 Emergency Lighting and Power Equipment
 - 5. UL 773 Plug-In Photo controls for Use with Area Lighting
 - 6. UBC Standard Section 47.1813 Luminaires
 - 7. IES LM-79-08 Electrical and Photometric Measurements of Solid State Lighting
 - 8. IES LM-80 Method for Measuring Lumen Maintenance for SSL Light Sources
- B. Definitions:
 - 1. BF: Ballast factor.

2. CCT: Correlated color temperature.
3. CRI: Color-rendering index.
4. LER: Luminaire efficacy rating.
5. Lumen: Measured output of lamp and luminaire, or both.
6. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

- A. Comply with requirements of specification section describing Submittal Procedures.
- B. The authorized manufacturer's representative for the project area shall prepare submittals for each lighting fixture type. In addition to the fixture submittals, a list shall be provided identifying the manufacturer representative for each fixture type. Provide manufacturers' names, addresses, and telephone numbers. Requests for prior approval shall also include this information. Submittals or requests for prior approval without this information will be rejected.
- C. Product Data shall indicate that light fixture lamps, and ballasts fully comply with contract documents. Data shall be submitted for each type of light fixture indicated, arranged in order of fixture designation. For standard catalog fixtures provide original product catalog sheets indicating data on features, accessories finishes, and the following:
 1. Materials and dimensions of luminaires.
 2. Photometric data, in IESNA format, based on certified results of laboratory tests complying with IESNA Lighting Measurements Testing & Calculation Guides of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the light fixture as applied in the Project.
 - a. Photometric data shall be certified by a qualified independent testing agency.
 - b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
 3. Emergency lighting unit battery and charger.
 4. Low voltage transformers.
 5. LED power supplies.
 6. Types of lamps, including manufacturer, wattage, Color Rendering index (CRI), Color Temperature in degrees Kelvin (K), color shift over life, and efficacy (lumens/watt).
 7. Air and Thermal Performance Data: For air-handling light fixtures, furnish data required in "Submittals" Article in Section "Diffusers, Registers, and Grilles."
 8. Sound Performance Data: For air-handling light fixtures, indicate sound power level and sound transmission class in test report certified according to standards specified in Section "Diffusers, Registers, and Grilles."
- D. Shop Drawings shall:
 1. Show details of nonstandard or custom fixtures.
 2. Indicate dimensions, weights, methods of field assembly, components features, and accessories.
 3. For custom fixtures or modified fixtures submit scaled drawings prepared by the manufacturer showing all details of construction, lengths of runs, pendant and power feed locations, accessories, finished, and lists of materials.

4. Contractor to provide the manufacturer with accurate field dimensions where required.
 5. Wiring diagrams, power and control wiring.
- E. Wiring Diagrams shall detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.
- F. Product samples, complete with housing, trim, specified lamp, ballast/transformer, and 8' cord with plug shall be submitted if requested.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Not Required.
- B. Coordination Drawing shall include reflected ceiling plans, sections, and other details drawn to scale and coordinating the following items:
1. Light fixtures.
 2. Suspended ceiling components.
 3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
 4. Ceiling-mounted projectors.
 5. Structural members to which suspension systems for light fixtures will be attached.
 6. Other items in finished ceiling including the following:
 - a. Air outlets and inlets
 - b. Speakers
 - c. Sprinklers
 - d. Smoke and fire detectors
 - e. Occupancy sensors
 - f. Access panels
 7. Perimeter moldings.
- C. Product Certificates shall be signed by manufacturers of lighting fixtures certifying that products comply with requirements.
- D. Dimming Ballast Compatibility Certificates shall be signed by the manufacturer of ballast certifying that ballasts are compatible with dimming systems and equipment with which they are used. Product certificates signed by the product manufacturer shall be provided for each type of ballast for bi-level and dimmer controlled fixtures.
- E. Maintenance Data shall be provided for lighting fixtures and equipment to include in emergency, operation, and maintenance manuals specified in specifications section describing Operations and Maintenance Data.
- F. Field quality control test reports.
- G. Special Warranties specified in this Section.

- H. Review of luminaire submittals which indicate voltage, mounting condition, or quantities shall not be considered to be approval of said voltage, mounting condition, or quantities. Contractor shall field verify voltage and actual mounting condition and method.

1.6 SUBSTITUTIONS

- A. Comply with requirements of specification section describing Product Requirements.
- B. Lighting fixtures are based on the fixture types and manufacturers specified. If substitution of fixtures other than those specified is desired, product information must be submitted to the Lighting Designer/Engineer 8 days prior to the close of the bid period. No requests for substitution will be accepted after this date.
- C. Substitution requests shall include all information required in paragraph 1.4 – ACTION SUBMITTALS.
- D. Equipment delivery lead time shall not be held as a valid reason for requesting luminaire substitution unless luminaire lead time from specified manufacturer is in excess of 14 weeks. It shall be the sole responsibility of the Contractor to determine necessary equipment lead times, deliver submittals for review in a timely fashion, and place orders accordingly to ensure timely delivery.
- E. When requesting a substitution, the contractor shall provide unit and extended pricing for specified luminaire, unit and extended pricing for proposed alternate, and unit and extended savings to the Owner to be realized by accepting proposed alternate. If requested, the Contractor shall provide unit pricing for each luminaire type specified to provide a baseline comparison for substitution requests.
- F. If the substitution request is accepted, approval will be in the form of an addendum to the contract documents and specifications issued to all registered plan holders.
- G. A maximum of two substitution requests shall be reviewed for any single fixture type. If a substitution has not been approved following this process, the Contractor shall provide the specified fixture.

1.7 QUALITY ASSURANCE

- A. STANDARDS: Refer to Section 26 00 01 - Electrical General Provisions as applicable.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- C. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation program for Energy Efficient Lighting Products.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- E. Comply with NFPA 70.
- F. FM Global Compliance: Lighting fixtures for hazardous location shall be listed and labeled for indicated class and division of hazard by FM Global.
- G. Luminaires, ballasts, lamps and other components and controls shall equal or exceed the requirements of all applicable state and/or municipal energy codes.
- H. Designated manufacturers are listed to define the requirements for quality and function of the specified product. Equivalent or better products of other, unnamed manufacturers may be proposed for consideration by adhering to procedures set forth in this section and in Specification Section 01600 – Product Requirements.
- I. Shop Drawings: Submit manufacturer's data on interior lighting fixtures. Submit dimensioned drawings of all lighting fixtures. Identify light fixtures by type and submit in alphabetical order.

1.8 COORDINATION

- A. Coordinate layout and installation of light fixtures with ceiling system and other construction that penetrates ceilings or is supported by them including mechanical system, fire suppression, AV, and partition assemblies.
- B. Provide all frames, supplementary support structures, hangers, spacers, stems aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed fixtures shall have frames that are compatible with the ceiling systems.
- C. Coordination Meetings: Meet with the ceiling installer to coordinate each light fixture mounting condition with ceiling type, and to coordinate fixture layouts in each area. Meet with the mechanical systems installer prior to fabrication and installation of ductwork. Coordinate depth and location of all light fixtures and ductwork in all areas.

1.9 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under the provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty for LED Lighting Fixtures: A warranty must be provided by the manufacturer made out to Owner for luminaires, covering repair or replacement of defective electrical parts (including light source and power supplies) within specified warranty period indicated below.
 - 1. Warranty Period: Five years from date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match product installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Glass and Plastic Lenses, Covers, Louvers, and Other Optical Parts: 10% or one dozen (whichever is less) of each type and rating installed. Furnish at least one of each type.
2. Globes and Guards: 5% of each type and rating installed. Furnish at least one of each type.
3. Adjustable Accent Lights (track, recessed, or surface mounted): One case or 20% (whichever is less) of each lamp type. A spot distribution and a flood distribution lamp are considered to be two different lamp types.
4. Lamps: 15% of each type and rating installed. Furnish at least one of each type.
5. Ballasts: 2% of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide light fixtures of types as indicated on drawings or as approved by addenda. Provide complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, ballasts, starters, wiring, etc. Provide all light fixtures with safety latches where applicable.
- B. Provide all detachable fixture parts, luminous ceiling accessories, louvers, diffusers, lenses, and reflectors with locking catches, screws, safety chains, or safety cables.
- C. Provide all light fixtures and support accessories as required for a complete system.
- D. Consult architectural drawings for louvers (if any) to be provided by Division 26.

2.2 MANUFACTURERS

- A. Catalog numbers specified represent the full catalogue number of the fixture. The fixture size shall correspond with the wattage indicated in the Light Fixture Schedule or the actual length of the fixture as indicated on the drawings.
- B. Acceptable manufacturers and full catalogue numbers are listed. The manufacturer listed shall provide complete fixtures equaling or exceeding the written specification. Verify these requirements and order fixtures as required for a complete and fully operational installation per the contract documents and per code.

2.3 GENERAL MATERIAL REQUIREMENTS

- A. Fixtures shall be free of light leaks while providing sufficient ventilation of lamps to provide the required photometric performance. Ballasts and transformers shall be adequately vented.
- B. Lamp-holders shall hold lamps securely against normal vibration and maintenance handling.
- C. Light fixtures containing lamps which require protective shielding shall be furnished with a tempered glass lens or approved unbreakable lens UL listed for the application.
- D. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- E. Metal Parts shall be free from burrs, sharp corners, and edges. Metal work shall be free from

tool marks and dents and shall have accurate angles bent as sharply as compatible with the gauges of the required metal. Intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. All miters shall be in accurate alignment with abutting intersection members.

- F. Sheet Metal Components shall be steel, unless otherwise indicated. Components shall be formed and supported to prevent warping and sagging. Luminaires to be painted after fabrication. Finish ferrous mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.
- G. Fixture hardware to comply with the following material standards: For steel and aluminum fixtures, all screws, bolts, nuts and other fastening and latching hardware shall be cadmium or equivalent plated. For stainless steel fixtures, all hardware shall be stainless steel. For bronze fixtures, all hardware shall be stainless steel or bronze.
- H. Doors, Frames, and other internal access shall be smooth operating, free from light leaks under normal operating conditions, and designed to permit relamping without use of tools.
- I. Provide supplemental safety device or arrange doors, frames, lenses diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Safety devices shall be detachable if necessary and shall not interfere with fixture performance, maintenance, or the seating of any fixture element. Safety device shall not be visible during normal fixture operation and from normal viewing angles.
- J. Luminaires provided must have means for disconnection from power during service, as required in the NEC Article 410.
- K. Reflecting Surfaces of light fixtures: Minimum reflectance as follows, unless otherwise indicated;
 - 1. White Surfaces: 85%.
 - 2. Specular Surfaces: 90%.
 - 3. Diffusing Specular Surfaces: 75%.
 - 4. Laminated Silver Metalized Film: 90%.
- L. Reflector cones shall adhere to the following criteria:
 - 1. Cones designed for vertically mounted lamps shall provide a minimum of 45 degree cutoff of lamp and lamp image. Cones designed for horizontally mounted lamps shall provide a minimum of 55 degree cutoff of lamp and lamp image. There shall be no visible lamp flashing in the cone.
 - 2. Plastic material shall not be used for reflector cones, unless otherwise specified.
 - 3. Cones shall not be permanently fastened to the housing or ceiling and shall be removable without tools. Retention devices shall not deform the cone or be visible from normal viewing angles.
 - 4. Trim shall be flush to the finished ceiling without gaps or light leaks. Where the flange trim is separate from the cone, it shall have the same finish as the reflector cone.
 - 5. Reflector cones shall be of uniform gauge, not less than 0.032" thick, high purity aluminum Alcoa 3002 alloy. Cones shall be free of spin marks or other defects.
 - 6. Manufacture cone using the Alzak process. Refer to the fixture schedule for cone color and finish (i.e. specular or diffuse) requirements.

- M. Lenses, Diffusers, Covers, and Globes shall be 100% virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
 - 1. Plastic, polycarbonate and acrylic shall be UV stabilized and shall have high resistance to yellowing and other changes due to aging, exposure to heat and ultraviolet radiation.
 - 2. Lens Thickness shall be a minimum of 0.125" unless other thickness is indicated.
 - 3. Lenses shall have uniform brightness throughout the entire visible area.
 - N. Adjustable light fixtures shall have positive locking devices to fix the aiming angle. Fixtures shall be capable of being relamped without adjusting the aiming angle.
 - O. Each lighting fixture that has a lamp with an oval shape beam pattern or a spread lens that defines beam orientation shall contain lamp or lens locking devices to ensure that lamp or lens orientation is not disturbed during future lamp replacement or cleaning.
 - P. All fixtures and ballasts must operate within the temperature limits of their design and as specified by Underwriter' Laboratories, Inc. in the applications and mounting conditions herein specified.
 - Q. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located 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 and ballast characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. CCT and CRI for all luminaires.
 - R. Fixtures recessed in suspended ceilings where the space above the ceiling is either an air supply or return plenum shall conform to NEC Article 300-22.
 - S. Provide plaster frame for recessed light fixtures mounted in other than T-bar ceilings. Verify mounting with architectural reflected ceiling plan before ordering light fixtures.
 - T. Fixtures for use in areas designated as damp locations shall be suitably gasketed to prevent the entrance of moisture. Provide approved wire mesh screens for ventilation opening. Dissimilar metals shall be separated by non-conductive material to prevent galvanic action.
 - U. Welding shall be done with electrodes and/or methods recommended by the manufacturers of the metals being welded. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth. All welds on or behind surfaces which will be exposed to view shall be done so that finished surface will be free of imperfections such as pits, runs, splatter, cracks warping, dimpling, depressions or other forms of distortion or discoloration. Remove weld spatter and welding oxides from all welded surfaces.
- 2.4 LED FIXTURES
- A. All Luminaires

1. Comply with IES LM79 and IES LM80 LED product testing procedures, and DOH energy Star requirements.
2. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable fixtures with external control and intelligence are exempt from this requirement. The power draw from such luminaires shall not exceed 0.5 watts when in the off state.
3. Color spatial uniformity shall be within .004 of CIE 1976 diagram.
4. Color maintenance over rated life shall be within .007 of CIE 1976.
5. Luminaires shall have a minimum CRI of 80.
6. Color shall fall within 200K of specified range.
7. LED modules shall be fully replaceable without replacing the fixture.
8. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management.
9. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver at least 70% of initial lumens, when installed in-situ, for minimum of 35,000 hours.

B. Power Supplies and Drivers

1. Power Factor 0.90 or higher
2. Operating temperature: minimum or -20°F (129°C) or below when used in luminaires intended for outdoor use.
3. Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
4. Output operating frequency: 120Hz.
5. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
6. Total Harmonic Distortion Rating: Less than 3 percent.
7. Meet electrical and thermal conditions as described in LM-80 Section 5.0.
8. Primary Current: confirm primary current with Electrical Drawings.
9. Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
10. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.
11. Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.

C. Controller and Control System

1. System electronics driver / controller to use coordinated communication protocols: DMX512, 0-10V, DALI, or proprietary as required.
2. Contractor to ensure that external control equipment is compatible with LED control requirements.
3. Provide connector types and wiring as appropriate for un-interrupted communication between devices, considering distance maximums, field obstructions, and accessibility. Ensure that connection points are optically isolated for system noise reduction.
4. For control components that are part of overall area control system see electrical Dimming Controls specification.
5. For stand-alone controlled LED systems the Light Fixture Schedule.
6. Compatibility: certified by manufacturer for use with individually specified luminaire and individually specified power supplies and/or drivers.

2.6 LAMPS

- A. Lamp each fixture with the proper quantity of lamps of the type specified in the Light Fixture Schedule.
- B. LED Lamps
 - 1. See Section 2.11, LED Fixtures.
- C. LED lamp manufacturer's to meet the requirements of Section 2.11, LED Fixtures. Unless otherwise indicated, provide all other lamps manufactured by one of the following:
 - 1. Osram/Sylvania
 - 2. Philips
 - 3. General Electric
 - 4. Ushio
 - 5. Venture
- D. All lamps of the same type are to be provided by the same manufacturer.

2.7 WIRING

- A. All wiring shall be as required by code for fixture wiring.
- B. All flexible cord wiring between fixture components or to electrical receptacles and not in wireways shall have a minimum temperature rating of 105 degrees Celsius.
- C. Cords shall be fitted with proper strain reliefs and watertight entries where required by application.
- D. No internal wiring shall be visible at normal viewing angles.
- E. For Tandem Wired fixtures in continuous rows and where required on Electrical Drawings or in the Light Fixture Schedule, supply ballasts and wiring to control all inboard lamps together and all outboard lamps together.

2.8 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section pertaining to General Electrical Provisions, paragraph entitled Equipment anchorage, Support, Seismic Restraint, and Bracing for fixture support and bracing.
- B. Where the ceiling is of insufficient strength to support the weight of the lighting fixtures, provide additional framing from building structure to support luminaires as required. Do not support fixtures from ceiling T-Bar system.
- C. Single-Stem Hangers shall be ½ -inch (13-mm) steel tubing with swivel ball fitting and ceiling canopy. Finish shall be the same as the luminaire.
- D. Twin-Stem Hangers shall be two, ½ inch (13-mm) steel tubes with single canopy arranged to mount a single fixture. Finish shall be the same as the luminaire.

- E. Rod hangers shall be 3/16-inch (5-mm) minimum diameter, cadmium-plated threaded steel rod.
- F. Wires shall be ASTM A 641/A 641M, Class 3, soft temper, zinc coated steel, 12 gauge (2.68-mm).
- G. Wires for humid spaces shall be ASTM A 580/A 580M, composition 302 or 304, annealed stainless steel, 12 gauge (2.68-mm).
- H. Hook Hangers shall be integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- I. Aircraft Cable Support shall use cable anchorages, and intermediate supports recommended by fixture manufacturer.
- J. Hangers for Pendant Industrial Fixtures shall be heavy duty No. 8 jack chain with hangers, "S" hooks, mounting, straps, and all required accessories for complete installation.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install interior and exterior building light fixtures in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

3.2 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
- B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- D. Mounting height indicated in drawings from finished floor to bottom of pendant light fixture or to the center of the outlet box for all mounted light fixtures unless otherwise noted. Verify mounting heights with Architect and Lighting Designer/Engineer.
- E. Mounting height may also be indicated as the length of the pendant below finished ceiling.
- F. Provide all necessary hanging or mounting devices and accessories for all fixtures. Verify the types needed for various ceiling conditions. Plaster rings shall be provided where required.

- G. Verify weight and mounting method of all fixtures prior to ordering and provide suitable support. Coordinate with General Contractor for fixtures that require additional blocking or support. Fixture mounting assemblies shall comply with all local seismic codes and regulations.
- H. Refer to architectural reflected ceiling plans for coordination of light fixture locations with mechanical and fire safety equipment. Where conflicts occur, coordinate with Architect and Lighting Designer/Engineer prior to installing any of the systems.
- I. In accessible suspended ceilings, fixture wiring connection, including equipment grounding conductor, is to be through use of 72-inch flexible conduit from a rigidly supported junction box.
- J. Wire per requirements of branch circuit installation. Properly ground each fixture.
- K. Light fixtures located in recessed ceilings with a fire resistive rating of 1 hour or more shall be enclosed in an approved fire resistive rated box equal to that of the ceiling.
- L. Install fixtures with vent holes free of air blocking obstacles.
- M. Contractor shall be responsible for adjusting aperture flanges or rings on all recessed fixtures to be flush with the finished ceiling. Fixture trim shall completely conceal ceiling opening.
- N. Adjust variable position lampholders for proper lamp position prior to fixture installation.

3.3 FIXTURE SUPPORT

- A. Comply with specifications section describing General Electrical Provisions, paragraph entitled Equipment anchorage, Support Seismic Restraint, and Bracing for fixture support and bracing.
- B. Provide all necessary hanging or mounting devices for all fixtures, verify the type needed for various ceiling conditions. Plaster rings shall be provided where required.
- C. Ceiling Fixture Support: Where ceiling is of insufficient strength to support weight of light fixtures installed, provide additional framing from building structure to support as required.
- D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
 - 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
 - 2. Electrical Contractor is to provide and install locking clips for all fixtures installed in suspended ceilings that are UL listed for the application. The locking clip is to be attached to the fixture with a sheet metal screw or similar device and secured to the main or supporting T-bar runner to guarantee a secure installation. Clips shall be located at or near fixture corners.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.

4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- E. Suspended Lighting Fixture Support:
1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 3. Brace suspended luminaires installed near ducts or other elements so that they do not swing into obstructions.
 4. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 5. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- F. Provide two slack No. 9 safety wire hangers or threaded rods for each recessed mounted fixture. Secure form opposite corners of each fixture and fasten to structure above, independent of ceiling system. Locate supports not more than 6 inches from fixture corners.
- G. Metal decking shall not be pierced for luminaire support.
- H. Wall mounted light fixtures shall be supported from four-square outlet box plaster ring and from wall at non-feed end with two 1/4 –inch toggle bolts for gypsum board walls or 1/4 –inch bolts to pre-set inserts for concrete wall.
- 3.4 IDENTIFICATION
- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- 3.5 LED FIXTURES
- A. Adhere to manufacturer's installation guidelines regarding proper thermal management.
- 3.6 LIGHTING CONTROL
- A. Provide branch circuiting in coordination with lighting control requirements of specification section describing Lighting Control Equipment and as indicated on Electrical Drawings.
- 3.7 PROTECTION, CLEANING AND ADJUSTING
- A. Protect installed and non-installed fixtures from damage during construction period.
- B. Remove protective plastic covers from light fixtures and fixture diffusers only after construction work, painting and clean-up are completed. Remove, clean and reinstall all dirty lamps, reflectors and diffusers.
- C. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer for cleaning Alzak reflectors and other surfaces.

- D. Make final adjustment of aimable light fixtures and adjustable light settings under the direction of the Lighting Designer during a scheduled period of time prior to the completion of the project, after normal business hours if required. Include all equipment and personnel expenses including overtime required for focusing.
- E. Fixtures, reflectors, and accessories which are damaged, blemished or impregnated with fingerprints shall be replaced at the contractor's expense. All finishes shall be unmarred upon project completion.

3.8 FIELD QUALITY CONTROL

- A. Coordinate all testing procedures and schedule with the specification section describing Commissioning Agent – Demonstration and Training. All testing is to be documented with test procedures, results and initials of witnessing personnel and submitted to Commissioning Agent.
- B. Coordinate inspection and testing of Light Fixtures with specification section describing – Lighting Control Equipment.
- C. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- D. Replace all burned out lamps or inoperative lamps at the end of construction prior to Owner occupancy.
- E. Advance Notice: Give dates and times for field tests.
- F. Provide instruments to make and record test results.
- G. Test as follows:
 - 1. Verify proper operation, switching and phasing of each fixture after installation.
 - 2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation. Verify normal transfer to generator and retransfer to normal.
 - 3. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to the lighting system, retest to demonstrate compliance with standards.
- H. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until unit operates properly.

3.9 SPARE PARTS

- A. Acrylic Diffusers: Provide a spare acrylic diffusers and/or glass for each light fixture type and one for each additional unit for each 10 fixtures. The quantity of any single type need not exceed 10.

END OF SECTION 260510

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Grounding conductors.
 - 2. Grounding connectors.
 - 3. Grounding busbars.
 - 4. Grounding labeling.

1.3 DEFINITIONS

- A. BCT: Bonding conductor for telecommunications.
- B. EMT: Electrical metallic tubing.
- C. TGB: Telecommunications grounding busbar.
- D. TMGB: Telecommunications main grounding busbar.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For communications equipment room signal reference grid. Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
 - 1. Ground and roof rings.
 - 2. BCT, TMGB, TGBs, and routing of their bonding conductors.
- B. Qualification Data: For Installer, installation supervisor, and field inspector.
- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Result of the ground-resistance test, measured at the point of BCT connection.
 - b. Result of the bonding-resistance test at each TGB and its nearest grounding electrode.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Installation Supervision: Installation shall be under the direct supervision of ITS Installer 2, who shall be present at all times when Work of this Section is performed at Project site.
 - 2. Field Inspector: Currently registered by BICSI as a registered communications distribution designer to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

- A. Comply with J-STD-607-A.

2.2 CONDUCTORS

- A. Comply with UL 486A-486B.
- B. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
 - 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
 - 2. Cable Tray Equipment Grounding Wire: No. 6 AWG.
- C. Cable Tray Grounding Jumper:
 - 1. Not smaller than No. 6 AWG [26 kcmils (13.3 sq. mm)] and not longer than 12 inches (300 mm). If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. If jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.
- D. 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 kmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS

- A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- B. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
 1. Electroplated tinned copper, C and H shaped.
- C. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.
- D. Busbar Connectors: Cast silicon bronze, solderless compression or exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.
- E. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING BUSBARS

- A. TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, [1/4 by 4 inches (6.3 by 100 mm)] in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as TMGB and shall comply with J-STD-607-A.
 1. Predrilling shall be with holes for use with lugs specified in this Section.
 2. Mounting Hardware: Stand-off brackets that provide a [4-inch (100-mm)] clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- B. TGB: Predrilled rectangular bars of hard-drawn solid copper, [1/4 by 2 inches (6.3 by 50 mm)] in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-A.
 1. Predrilling shall be with holes for use with lugs specified in this Section.
 2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch (50-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

- C. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-A. Predrilling shall be with holes for use with lugs specified in this Section.
1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
 2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19- or 23-inch (483- or 584-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
 3. Rack-Mounted Vertical Busbar: 72 or 36 inches (1827 or 914 mm long, with) stainless-steel or copper-plated hardware for attachment to the rack.

2.5 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.
- B. Inspect the test results of the ac grounding system measured at the point of BCT connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.
- B. Comply with NECA 1.
- C. Comply with J-STD-607-A.

3.3 APPLICATION

- A. Conductors: Install solid conductor for No. 10 AWG and smaller and stranded conductors for No. 8 AWG and larger unless otherwise indicated.

1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than No. 3/0 AWG.
 2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than No. 3/0 AWG.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2 AWG minimum.
- C. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Connections to Structural Steel: Welded connectors.
- D. Conductor Support:
1. Secure grounding and bonding conductors at intervals of not less than 36 inches (900 mm.)
- E. Grounding and Bonding Conductors:
1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
 2. Install without splices.
 3. Support at not more than 36-inch (900-mm) intervals.
 4. Install grounding and bonding conductors in PVC conduit sized in accordance with the NEC until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.
 - a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing and bond both ends of the conduit to a TGB.

3.4 GROUNDING ELECTRODE SYSTEM

- A. The BCT between the TMBG and the ac service equipment ground shall not be smaller than No. 3/0 AWG.

3.5 GROUNDING BUSBARS

- A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 12 inches (300 mm) above finished floor unless otherwise indicated.

3.6 CONNECTIONS

- A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.
- B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

- C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
 - 1. Use crimping tool and the die specific to the connector.
 - 2. Pretwist the conductor.
 - 3. Apply an antioxidant compound to all bolted and compression connections.
 - D. Primary Protector: Bond to the TMGB with insulated bonding conductor.
 - E. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot (1 sq. mm/linear meter) of conductor length, up to a maximum size of No. 3/0 AWG [168 kcmils (85 sq. mm)] unless otherwise indicated.
 - F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install top-mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.
 - G. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.
 - H. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.
 - I. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.
 - J. Electronic System Equipment: Bond equipment chassis of other electronic system equipment including fire alarm, intrusion detection, access control, video surveillance, and public address system to the TGB or TMGB located in their respective communication rooms.
- 3.7 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS
- A. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
 - B. Comply with IEEE C2 grounding requirements.
 - C. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches extends above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

- D. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect grounding conductors to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

3.8 IDENTIFICATION

- A. Labels shall be preprinted or computer-printed type.
 - 1. Label TMGB(s) with "fs-TMGB," where "fs" is the telecommunications space identifier for the space containing the TMGB.
 - 2. Label TGB(s) with "fs-TGB," where "fs" is the telecommunications space identifier for the space containing the TGB.
 - 3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
 - a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
 - 3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
 - a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB and in each TGB. Maximum acceptable ac current level is 1 A.
- D. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.
- E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 270526